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ANNUAL REPORT

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COMMONWEALTH MYCOLOGICAL INSTITUTE
-9 SEP 1971

DEPARTMENT OF AGRICULTURE

NEW SOUTH WALES

No. 224

1969–70

PARLIAMENT OF NEW SOUTH WALES

REPORT

OF THE

DEPARTMENT OF AGRICULTURE

FOR THE

Year ended 30 June, 1970

Ordered to be printed, 22 *October*, 1970

BY AUTHORITY
V. C. N. BLIGHT, GOVERNMENT PRINTER, NEW SOUTH WALES—1971

P 33209—1 1970—368 [$3.60]

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SENIOR ADMINISTRATIVE PERSONNEL*

As at 30th June, 1970

Minister	Hon. G. R. Crawford, M.L.A.
Director-General	R. M. Watts
Deputy Director-General (R.E.)	Dr F. C. Butler
Deputy Director-General (P.T.)	B. Owen French
Secretary	J. L. Hager
Research Co-ordinator	K. E. Hutton
Executive Officer (Agricultural Education)	J. E. Jessup
Accountant	E. A. Bragg
Chiefs of Divisions:	
Animal Industry Division	R. A. Hall
Dairy Division	D. W. Crowfoot
Horticulture Division	G. R. Gregory
Plant Industry Division	L. R. Kavanagh
Marketing and Agricultural Economics Division	C. J. King
Information Services Division	H. Parry Brown
Extension Services Division	B. D. Ament
Research Stations Division	N. K. Golding
Principals, Major Agricultural Colleges:	
Hawkesbury Agricultural College	B. Doman
Wagga Wagga Agricultural College	B. F. Atkins
Biological and Chemical Research Institute:	
Director	T. H. Johns
Royal Botanic Gardens and National Herbarium:	
Director and Chief Botanist	N. K. Mair

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* For more detail of staff of the various Divisions, Branches, Institutions, Regions, etc., see the Department's brochure *Directory of Officers.* For staff numbers see *Appendix IIIB* of this Report.

NEW SOUTH WALES

DEPARTMENT OF AGRICULTURE

Report of the Director-General to the Minister for the Year ended 30th June, 1970

Department of Agriculture,
SYDNEY.
7th October, 1970.

Dear Sir,

In the deeply regretted absence of the Director-General Mr R. M. Watts, through prolonged illness, it has become my privilege to submit herewith the Report of the New South Wales Department of Agriculture for the 12 months ended 30th June, 1970.

Yours faithfully,
F. C. BUTLER,
Acting Director-General.

NOTES FROM CENTRAL ADMINISTRATION

Notes on the Seasons

TWELVE MONTHS SUMMARY

When the 12 months opened in July, 1969 there was a surplus of pasture growth in most parts of the State. Exceptions to the lush conditions were some northern parts of the Western Division, and the northern tablelands and unimproved north coast areas. These had missed or had not received enough of the June, 1969 rains to offset earlier drought conditions.

The very mild 1969 winter gave way to bitter cold in September, followed in October and November by flood rains. Then from December, 1969 to June, 1970, except in January and in April, rainfall was generally below average.

In effect, 1970 brought a return to drought conditions which, by the end of June, extended over most of the far western, northern inland and central coast areas.

The worst mice plague for decades developed during the 12 months. In the southwest and centralwest the plague did a great deal of damage.

MONTH BY MONTH

In July, 1969 the main exceptions to a very pleasing pastoral situation were the aforementioned northern parts of the Western Division and parts of the northern tablelands and north coast. Conditions were lush in many areas, and the winter was very mild and favourable.

In the July–August period, pastures and fodder crops made early and prolific growth because of the well-spaced rainfall and the unusually mild winter-weather. Native grasses were slower to respond.

At the start of September the outlook for spring ranged from good to excellent—until the mild weather gave way in that month to bitter cold; bad frosts and bitterly cold windy conditions through almost all of September—particularly on parts of the tablelands and slopes. Pasture growth was brought virtually to a standstill there, and livestock endured a very difficult period.

The September reversion to conditions more akin to a bitter winter was followed by good rains in October and November; in fact flood rains in some areas. Torrential storms over much of the central and northern inland in the second week of October led to floodings of the lower reaches of the Castlereagh and Macquarie Rivers. Though most of the remainder of the State received good rains at this time, the lower Western Division and Riverina were less fortunate.

In many areas, normal spring growth had resumed by mid-October and was consolidating the earlier, widely favourable winter conditions. By the end of October there was ample to excessive feed, and plenty of water. Major exceptions were the northern half of the Western Division and parts of the northern tablelands.

In the first three weeks of November there were frequent and often heavy rains, except in the northern Western Division; followed by varied conditions in December including: scattered thunderstorms, hail and strong winds; dust storms in the Far West; rainfall below average in all Divisions. Temperatures, except for the odd hot day, were unseasonably cool over this period.

January brought unsettled weather—some very hot days, often followed by thunderstorms and violent winds. Rainfall in January was, in general, above average. But dry weather set in and, except for patchy thundershowers, persisted through February. There was a lot of hot weather in February, and the Riverina and Far West had heatwaves. Pastures deteriorated in consequence.

In March the position looked better but again the season took a dry turn which continued to mid-April.

Light, widespread rains from mid-April culminated in moderate to heavy rains on 23rd and 24th—covering the entire State, including the parched Western Division. Many districts received at this time their best rainfall registrations for several months.

The outlook for the 1970 winter was promising at this stage, though much more rainfall was needed.

Then, unfortunately, May and June in most districts inclined to cold conditions—with rainfall well below average. Frosts were frequent, particularly on the highlands; pastures dried out seriously in all northern inland areas, and on the coast north of Sydney to the Queensland border; feed became short in most districts along the northern border, and the north coast and Hunter Valley were in drought conditions. Elsewhere the feed situation was adequate to good.

Signs, late in the autumn and early in the winter of 1970 following the lengthy dry spells earlier in 1970, were ominously reminiscent of the early stages of the disastrous 1965 drought but had not attained that severity by the end of June, 1970—the close of the 12 months under report. When the ensuing 1970–71 year began in July, 1970 there were 14 Declared Drought Areas in the State.

LIVESTOCK CONDITIONS AND MOVEMENTS

New South Wales livestock, generally, had had good to excellent feed supplies during the latter half of 1969. Extensive movements of stock from drought-affected areas of Queensland boosted the N.S.W. stock population; especially cattle. Cattle in large numbers from Queensland had been absorbed by the end of September. Local stock had maintained excellent condition but the sheep and cattle brought in from Queensland were often very poor and took time to improve.

In the new year, 1970, reduction of stock numbers in far northwestern properties proceeded—as conditions worsened. In March and April large numbers of near-starving sheep were moved to relief country in the south of the State.

Though pastures deteriorated in May and June most stock maintained strong condition; but in the hard-hit northern and western areas most had suffered and were being assisted by extensive supplementary feeding.

CROP CIRCUMSTANCES

Ground preparation for wheat and other winter cereals was made difficult by the spasmodic, unreliable 1970 autumn rainfall conditions. The introduction of wheat-delivery quotas also had a major effect. By mid-autumn it was apparent that the acreage sown to wheat would be substantially less than in 1969.

As soils became drier, northern and western wheat sowings were postponed or, in some cases, made on dry seed-beds. At the end of June, 1970, a large proportion of the intended wheat-acreage in the north had still not been sown, but most of the central and southern sowings were near to complete.

The Department's preliminary estimate for the 1970 wheat area was 6,000,000 acres; considerably less than the sowings of recent years and especially the 10,173,000 acres sown (for all purposes; including 9,953,000 acres for grain) in 1968.

Good germination and early growth were reported but the outlook was not promising; good rains were needed, to maintain growth and promote secondary root development. Such rains were especially needed in northern areas, if further sowings were to be possible and to save early-sown crops from wilting.

In respect of oats and barley sowings in 1970, the Department's preliminary estimates were 2,100,000 acres of oats and 800,000 acres of barley; oat sowings slightly less and barley sowings slightly more than in 1969. Prospects for each, in terms of weather, were much the same as for wheat.

Notes on Commodity Production

Production of the main agricultural crops in the State generally reached high levels, and some records were achieved.

CEREALS

Wheat—Less Acreage, Lower Production

Preliminary figures (the Bureau of Census and Statistics figures not yet available) indicated that 8,700,000 acres were sown for all purposes; 8,500,000 for grain; that the grain yield was 167,000,000 bushels at a yield average of 19·6 bush/acre (21·6 in the previous year). The significant drop in acreage from the previous year's 10,173,000 acres (9,599,000 for grain) was due mainly to the declaration of delivery quotas—reflecting the world wheat surplus situation—and, in some areas the prolonged waterlogging during the intended sowing period. Late frosts, and stem-rust damage, significantly reduced the potential yield average.

Oats—Near to Record Production

By estimate, the 1969–70 oat crop was the second-from-best on record; inferior only to the 1966–67 record of 41,000,000 bushels. The estimate was 36,000,000 bushels of grain, from 1,400,000 acres, at a yield average of 25·5 bush/acre. Total sowings for all purposes were estimated at 2,200,000 acres, including 140,000 that yielded 250,000 tons of hay and 660,000 acres for green forage.

Barley—Record Acreage and Production

Again by estimate, some 600,000 acres were sown for grain and yielded 15,000,000 bushels—at a yield average of 25 bush/acre. The acreage and the grain production would each be a record.

Maize—Increased Acreage and Harvest

Although the mice plague severely damaged some central and southern crops, the 1970 harvest is estimated to have reached 5,000,000 bushels—the best since the 1912–13 season. By estimate the acreage sown for grain (approaching 100,000 acres) was 52 per cent higher and the production 66 per cent higher than in the previous season. Some 36,000 acres were under irrigation, as against 18,000 in the previous season.

Grain Sorghum—Record Acreage and High Production

A record total of near-to 8,000,000 bushels is estimated to have been harvested in 1970; a dramatic increase on the previous year; even though the mice plague caused damage sufficient to bring back the initial estimate of 10,000,000 to 8,000,000.

Circumstances in the wheat industry encouraged the record sowing of 265,615 acres (estimated); 93 per cent more than in 1969. Of the estimated 265,615 acres, some 75,620 were under irrigation.

Rice—Record Acreage but Lower Yield Average

Rice acreage increased to nearly 97,000; some 14,000 acres more than in 1968–69. This reflected the increase to 30 acres in minimum allocation for rice-growing, and the allocation of rice areas to new Coleambally farms. Some 239,528 tons of rice had been delivered at the time of preparation of this report; a calculated yield average of 2·48 ton/acre—the lowest since 1964–65. An unfavourable season and mice attacks were the reasons. The record production was 251,100 tons in 1969.

FIBRE AND OIL CROPS, ETC.

Cotton—Comparable Acreage but Lower Production

The 1969–70 area of cotton, estimated at 60,700 acres, was comparable with the previous year's record total but production—estimated at a little less than 100,000 bales—averaged 1·6 bales/acre, some 16 per cent lower than the 1968–69 yield average. Adverse seasonal conditions provided the explanation; but it is notable also that Macquarie Valley-Bourke acreage increased from 8,084 in 1968–69 to about 10,600 in 1969–70, and averaged 1·3 bales/acre, as against 1·7 per acre from the Namoi Valley's 50,000 acres of cotton.

Tobacco—Continued Upward Trend on Acreage and Production

Tobacco sowings continued their upward trend of the last five seasons and, though still well below the 1960–61 record 3,400 acres, reached an estimated 2,740 acres; 50 per cent more than in 1967–68 and 25 per cent more than in 1968–69.

Estimated production was near to 3,000,000 lb green leaf; about 1,100 lb/acre. This would be the highest production since 1961–62. It exceeded the State's basic quota (2,870,000 lb) but not the total quota which—for the past season—was increased, again, to 3,078,000 lb.

Soybeans—Record Acreage but Low Production Average

A record 9,000 acres were sown to soybeans for the 1969–70 season, as against 1,370 for the previous season and the 100 acres of six years ago. But about 1/5th of the acreage failed to establish. Yield average of the harvested area has been estimated at 15 bush/acre. Seed quality, bad irrigation layout and water management, and mice attacks, all affected production.

Linseed—Record Acreage and Production

Linseed sowings in N.S.W. expanded to 50,000 acres, or a little more, in 1969–70, and approximated 17,500 tons (doubling the 1964–65 record). The yield average, about 14 bush/acre, ranks high for N.S.W.

The acreage almost doubled the 1964–65 record area and was a direct effect of the introduction of wheat quotas.

Safflower—Increased Acreage (1970), *and Improved Yield Average* (1969–70)

Information from District Agronomists has led to an estimate that some 17,000 acres were sown to safflower in 1970. There have been big fluctuations in recent years; e.g. 2,539 in 1966; 5,092 in 1967; 8,550 in 1968; 2,415 in 1969, and 17,000 in 1970.

The 1969–70 crop was the most successful for some years. Yield average for N.S.W. for 12 years up to 30th June, 1968 was 9·3 bush/acre but the 1969–70 yield average was estimated at 16 bush/acre. October–November rainfalls in the central west provided the conditions for high yields in well drained soils.

Sunflower—Dramatic, Record Acreage

An upward trend in acreage of this oilseed crop has been apparent since 1964: 50 acres in 1964; 89 in 1965; 156 in 1966; 1,025 in 1967; 638 in 1968; 4,400 in 1969; but 37,000 in 1970. And 60 per cent of this record acreage was irrigated.

Results however were disappointing. The mice plague was a major but not the only reason. Yield average was probably not more than 500 lb/acre.

Oilseed Rape—the First Commercial Production in N.S.W.

The first commercial production in N.S.W. occurred this season; 2,200 acres sown and a yield of about 700 tons.

At the end of the 12 months under report, farmers' intentions were to sow 50,000 or more acres of oilseed rape in N.S.W. for the next crop. Again, the wheat industry circumstances have been significant in this development.

FRUIT AND ALLIED INDUSTRY

Citrus Fruits—Production Increased only Slightly

The final estimate of 1969–70 citrus production was 7,020,000 bushels (comprising 6,530,000 bushels of main crop, plus 190,000 bushels of second crop Valencia oranges, and 300,000 bushels of summer crop lemons). This was only 80,000 bushels more than the 1968–69 total, and was 440,000 bushels less than the 1967–68 crop.

Pome Fruits: Apples Lower; Pears Higher

The 1969–70 apple crop was estimated at 3,782,716 bushels; almost 200,000 bushels less than the record 1968–69 crop. The pear crop was estimated at 912,581 bushels, a record; about 200,000 bushels more than the record 1968–69 crop. Pear-size was below average in many districts, through the heavy cropping and, in non-irrigated areas, the dry pre-harvest conditions.

Stone Fruit Production

Apricots and Peaches for Canning.—Murrumbidgee Irrigation Area yields were affected by tree-deaths and tree-removals caused by the 1969 wet winter, and by the unfavourable blossoming period (frosts and brown-rot blossom blight). The M.I.A. apricot crop was 4,101 tons (3,663 tons to canneries) as against the 6,504 tons in 1968–69 and the 9,371 tons in 1966–67. The M.I.A. peach crop, 16,589 tons, was slightly better than the 1968–69 crop but was less than 80 per cent of the 1967–68 crop (21,086 tons).

Prunes.—Final 1969–70 figures for dried prunes are not yet available but total N.S.W. production would approximate 4,000 tons, as against 2,966 tons in the previous year. The record tonnage was 5,316 in 1966–67.

Banana Production Higher But Not a Record

The total produced and marketed in 1969–70 was 3,895,860 bushels; 300,389 more than in the previous year but near to a million bushels less than the record 4,840,180 bushels in 1967–68.

In 1969–70 the production average, for the 21,181 acres of bearing bananas, was 184 bushels/acre—an improvement on the previous year's average.

Wine Grapes and Wine Industry—Records Again

Consistent with the trend, since 1961, of increasing production of wine grapes in N.S.W., the State's 1970 vintage has been estimated as a record 67,000 tons. The previous record, 54,313 tons, was harvested in 1969. Similarly, wine production would be a record, though figures are not available at this time.

Increasing consumption of table wines has ensured a keen, continuing interest in development of new and expansion of existing vineyards. During 1968 and 1969 some 3,622 acres were planted to wine grapes—bringing to 12,827 acres the total area in N.S.W.

Dried Vine Fruits—Near Record Production

Production of dried vine fruits in N.S.W. for 1970 has been estimated as 14,900 tons, as against the low total of 7,800 tons in the previous year and the record 14,951 tons in 1966–67. The area under dried vine fruits varieties in N.S.W. was 9,687 acres at December, 1969; new plantings have averaged 177 acres per year for the past three years—sufficient only to maintain the present acreage after allowance for vine removals.

MEAT PRODUCTION HIGHER

Only preliminary figures for the 1969–70 season are available as yet. These include the following, and most would be record achievements:

Beef and Veal

Production of beef and veal approximated 272,730 tons compared with 217,010 tons in 1968–69. This output has only been exceeded twice in the previous decade and is the fourth-from-highest on record. The record was 303,420 tons produced in 1964–65. The rise in output was due solely to increased beef production. Veal output again fell.

Mutton and Lamb—Record Production

Production of mutton and lamb totalled a record 233,970 tons. The previous record was 223,940 tons, in 1968–69.

Pigmeats and Bacon and Ham—High Production

Production of pigmeats, other than bacon and ham, again rose, reaching a record figure of 48,610 tons. The previous record, 46,310 tons, was in 1968–69. Bacon and ham output totalled 15,950 tons, the best since the 17,410 tons in 1945–46 and the third-from-highest on record.

Poultry Meats—Record Production

Poultry meat production again rose, to a new record of 58,000 tons; considerably above the previous record of 51,470 tons in 1968–69.

Meat-chicken hatchings, including 1,846,000 from egg strains, soared to a new record of 43,310,000; considerably above the 36,753,000 hatched (including 1,191,000 from egg strains) in 1968–69.

Turkey poults hatched increased to 1,174,000, as against 931,000 in 1968–69.

DAIRY PRODUCTION HIGHER

Dairy-products output showed a sharp rise from the lower production of the year before Factory butter output was 28,510 tons, as against 23,290 tons in 1968–69; but still well below the 38,570 tons in 1966–67.

Factory cheese output jumped to a record 6,540 tons, as against 4,160 tons in 1968–69.

Production of milk in the Whole Milk Zone totalled 159,730,000 gallons, a considerable increase over the 149,370,000 gallons in 1968–69; but only slightly higher than the output in each of the two previous seasons.

EGGS—A RECORD

Commercial egg production leapt to a new record of 82,020,000 dozen, well above the 1968–69 record 76,062,000 dozen. This was the seventh successive year of increased production.

WOOL DELIVERIES

First-hand deliveries of wool from the 1969–70 wool clip into the three main broker centres at Sydney, Newcastle, and Goulburn, totalled 1,536,421 bales; compared with 1,428,157 bales delivered in 1968–69.

Total receivals, including carryovers from the previous season and wool received for re-sale, were 1,635,704 bales. Of these, 1,585,218 bales were sold. Total receivals in 1968–69 were 1,514,438 bales. Of these, 1,442, 594 bales were sold.

Excluding 722 bales shipped abroad for sale, 49,764 unsold bales were held in store at the end of June, 1970.

STOCK NUMBERS

Only preliminary estimates of livestock numbers are available as yet. They are:

Sheep and Lambs—Record Total

At the end of March, 1970, the total of sheep and lambs was estimated at 72,900,000; considerably above the March, 1969 figure of 68,150,000, and exceeding the record 72,400,000 in March, 1965. Within five seasons the sheep and lamb total that existed prior to the 1965–68 drought has been passed.

Cattle—Record Total

The estimated total of cattle, beef and dairy, at March, 1970 was 5,520,000. This exceeds the previous record: 4,864,000 at March, 1969.

Pigs—Record Total

Pig total at March, 1970, set a record of 694,000. The March, 1969 total of 690,000 was the previous record.

Notes on Some Committees, Councils, Trusts

AUSTRALIAN AGRICULTURAL COUNCIL AND STANDING COMMITTEE ON AGRICULTURE

The Australian Agricultural Council had three meetings this year; one in Adelaide (July, 1969) and two in Sydney (September, 1969 and February, 1970). The Standing Committee on Agriculture met immediately before the Council meeting in Adelaide and the February meeting in Sydney.

The Council's September, 1969 meeting was convened specifically in relation to wheat industry stabilization matters.

FARRER MEMORIAL TRUST

The Annual and one Ordinary meeting of the Farrer Memorial Trust were held.

Mr C. S. Christian, Member of the Executive of the CSIRO, delivered the 1969 Farrer Memorial Oration ("Land Resources and Land Research") and was presented with the 1969 Farrer Memorial Medal, at a function at the University of Sydney in September, 1969 arranged in association with the Australian Institute of Agricultural Science.

Trustees have awarded the 1970 Farrer Memorial Medal to Dr J. Melville, Director of the Waite Agricultural Research Institute. Arrangements are in hand for a suitable occasion later in 1970, for Dr Melville's Oration and the Medal presentation.

Finances have largely precluded the calling of applications for the award of a Farrer Memorial Research Scholarship, but Trustees have given thought to the terms and conditions of future Scholarships.

ROYAL BOTANIC GARDENS AND GOVERNMENT DOMAIN TRUST

Four meetings of the Trust were held. Among the items under attention were the following: need of a new National Herbarium; a proposal for erection of a high-rise tower building in the Outer Domain; a proposal for construction of a music shell over the Domain Parking Station; negotiations for leasing the Botanic Gardens kiosk; various arrangements arising from the Captain Cook Bi-Centenary Celebrations, including the opening of a part of the Royal Botanic Gardens skirting Farm Cove (for viewing the Sydney Harbour Carnival festivities) on the night of 29th April, 1970, and the holding of a "Pop-concert" in the Domain; and provisions of car-parking space in the Domain for Christmas shoppers.

N.S.W. DAIRY INDUSTRY AUTHORITY CONSTITUTED

Last year's Report of the Department (1968–69) recorded that a Dairy Industry Advisory Council (for terms of reference see the 1967–68 Report of the Department) had submitted its report to the Minister for Agriculture in February, 1969 and that the report, aimed at unification and strengthening of the dairy industry, was under consideration by State Cabinet.

In the interim the Minister has announced constitution of the *New South Wales Dairy Industry Authority*. The Authority would assume control of milk supplies, over the whole of the State, from 1st July, 1970.

Chairman of the Authority would be Mr W. J. Hudson (Chairman of the N.S.W. Milk Board which would cease to function as such at 1st July, 1970); the Deputy Chairman would be Mr D. W. Crowfoot (Chief of the Division of Dairying, N.S.W. Department of Agriculture, until 30th June, 1970). Supplementary to the Authority would be: a *Dairy Industry Prices Tribunal*, with Mr Crowfoot as Chairman and with Mr P. C. Druce (A/Chief of the Department's Division of Marketing and Agricultural Economics) as one of the part-time members; and an *Artificial Breeding Advisory Board*, with Mr Hudson as Chairman and with the occupant of the following Department of Agriculture positions among the part-time members; the Chief of the Division of Animal Industry, a Principal Veterinary Officer, the Chief of the Division of Dairying, and the Principal Dairy Officer (Herd Improvement).

Dairymen, dairymen vendors and milk vendors supplying milk or cream for sale in N.S.W. would do so only from registered premises and, from 1st July, 1970, all applications for and renewals of registration would be handled by the new Dairy Industry Authority.

Notes on Some Senior Officer Retirements

RETIREMENT OF THE ACCOUNTANT—MR K. A. RUSSELL

Mr K. A. Russell retired in February, 1970 after five years as The Accountant, Department of Agriculture and almost 44 years in the New South Wales Public Service. He had started as Office Boy in the Wollongong District Works Office of the Department of Public Works in 1926 but in the same year transferred to the Department of Agriculture—to be Junior Clerk at Narara Viticultural Research Station. In 1927 he came to head office—to the Rural Industries Branch and in 1928 entered the Accounts Branch.

Apart from two years (1932–34) as Clerk at Trangie Experiment Farm and A.I.F. Service from 1941 to 1945, the remainder of his 44 years was spent in numerous classified positions within the Accounts Branch.

From August 1958 to September 1965 he was Assistant and at various times Acting Accountant. From September 1965 he was Accountant and until his retirement was also a member of the N.S.W. Bush Fire and Flood Relief Committee.

At his retirement there were many testimonies to his unsurpassed reputation throughout the Public Service for meticulous, practical accountancy.

Mr E. A. L. Bragg, formerly Assistant Accountant, has succeeded Mr Russell as Accountant.

RETIREMENT OF CHIEF OF DIVISION OF PLANT INDUSTRY—MR A. C. ORMAN

Mr A. C. Orman retired in March, 1970, after some 45 years as an officer of the Department of Agriculture. After graduating from Hawkesbury Agricultural College he joined the Department in 1926 as an Assistant Experimentalist and in the Experimentalist capacity he served at Glen Innes, Yanco, and Cowra Experiment Farms, and at Hawkesbury College for various periods up to 1932. At the College he acted also as an Instructor in Agriculture and as Farm Manager.

In the Field Branch (which preceded the "Division of Plant Industry"), working from head officer, he was appointed Agricultural Instructor in 1932, Senior Agricultural Instructor in 1937, Special Agronomist (Vegetables) in 1941, in the Division of Plant Industry, and in 1953 was appointed Principal Agronomist (Vegetables).

His specialist advice was drawn upon freely by the Commonwealth Government during the war years and, in 1956, also by the Northern Territory Administration.

In 1955 he studied vegetable improvement work in the U.S.A., Canada, U.K., and Europe and his subsequent report was widely sought throughout Australia.

In January, 1957 Mr Orman was appointed Deputy Chief and in August, 1968 Chief of the Division of Plant Industry.

Throughout his career he exhibited technical and administrative abilities of high order. His fame would rest in particular on his many contributions to advancements in the potato and vegetable industries.

Mr L. R. Kavanagh, formerly Deputy Chief has succeeded Mr Orman as Chief, and Mr E. W. Bowmaker, formerly Principal Agronomist (Extension) is the new Deputy Chief of the Division.

RETIREMENT OF THE CHIEF, DIVISION OF HORTICULTURE—MR R. R. KEBBY

Mr Kebby joined the Department in 1923 as Assistant Orchardist at Yanco Experiment Farm and during his 47 years service had been also Assistant Orchardist at Hawkesbury Agricultural College, Plant Diseases Act Inspector at Grafton, Orchardist at Grafton Experiment Farm, Fruit Instructor at Murwillumbah and Griffith and Leeton, Special Fruit Officer (Citrus) with headquarters in Sydney, Special Fruit Officer (Tropical Fruits) at Murwillumbah and, from 1960 to 1965, Principal Fruit Officer (Extension) with headquarters in Sydney. In 1965 he was appointed Deputy Chief and in 1967 Chief of the Division of Horticulture.

Throughout this long career of service to the New South Wales fruit industries Mr Kebby has been in high regard. He is perhaps most famed for his work in the banana industry. Therein he was closely involved in the design and implementation of the control scheme which helped to save that industry from extinction threatened in the 1930's by the Banana Bunchy Top disease.

Mr G. R. Gregory, Deputy Chief since 1967 has succeeded Mr Kebby as Chief of the Division of Horticulture. Mr J. K. Long, Principal Fruit Officer (Research), has succeeded Mr Gregory as Deputy Chief.

RETIREMENT OF THE DIRECTOR, ROYAL BOTANIC GARDENS, AND CHIEF BOTANIST—MR K. MAIR

Mr K. Mair, who retired with 30th June, 1970 as final day of duty, joined the Department 24 years ago as a Botanist in the National Herbarium, Royal Botanic Gardens. His entire career with the Department has been fulfilled in botanical research and, latterly, administration. Six years ago he was appointed Director and Chief Botanist—in effect head of the then Botany Branch of the Division of Science Services.

In 1968 the Botany Branch was severed from the Division of Science Services, to become a separate administrative unit with the full status of a Division.

Throughout his period as a senior administrator Mr Mair has striven diligently to achieve a new National Herbarium building in the Royal Botanic Gardens. His expressed thoughts on retirement have included a declaration of intention to continue that effort.

Dr J. S. Beard, Director of King's Park and Botanic Garden, Perth, Western Australia for the past eight years, has accepted appointment to the position vacated by Mr Mair and will take up the duties early in 1970–71.

RETIREMENT OF DIRECTOR, CATTLE TICK RESEARCH STATION—Dr R. N. McCULLOCH

Dr McCulloch retired in March, 1970, almost a year after attaining the retirement age of 65 years on 8th April, 1969. It is testimony that in the interests of this section of the Department's work for the cattle industries Dr McCulloch's services were so retained by approval of His Excellency the Governor and the Executive Council.

He had returned to the N.S.W. Department of Agriculture in 1961 to accept the position of Director, Cattle Tick Research, Wollongbar, after being in South Australia since early 1947 as Principal of the Roseworthy Agricultural College.

Initially he had entered the N.S.W. Department of Agriculture in 1922 as a Scientific Cadet, in Agriculture, at the University of Sydney. On graduating from University of Sydney he pursued post-graduate studies at Oxford University, as Rhodes Scholar from 1926 to 1929.

From 1929 to November, 1946 (less war service from 1942 to 1945), he was an entomologist in the N.S.W. Department of Agriculture and was author of many papers on external parasites of livestock. For a period before going to South Australia he was Lecturer-in-Charge, Entomology Sub-Section, School of Public Health and Tropical Medicine, University of Sydney.

In his term as Director of the Cattle Tick Research Station, Dr McCulloch's research and his direction of others' research have added a great deal of knowledge of the life cycle of the cattle tick; in particular the non-parasitic phases of the tick's life cycle, the means of carry-over and dispersal—the relationship of these to the cattle-dipping policies, and the evaluation of acaracides.

Notes on Some Organizational Changes/Developments

BIOLOGICAL AND CHEMICAL RESEARCH INSTITUTE, RYDALMERE

The Division of Science Services, Rydalmere, comprising the Biology, the Entomology and the Chemistry Branches, has been re-named as "Biological and Chemical Research Institute". Mr T. H. Johns, formerly designated Chief, Division of Science Services, has been re-designated as Director. Biological and Chemical Research Institute.

DIVISION OF RESEARCH STATIONS

The Research Stations Branch now has full Divisional status as Division of Research Stations. Mr N. K. Golding, formerly designated Chief of the Research Stations Branch, is now designated Chief of the Division. A position of Deputy Chief of the Division has been established and Mr G. A. Crawford has been appointed to it. Mr Crawford was formerly Principal Agronomist (Miscellaneous Crops) in the Division of Plant Industry.

The Division—basically responsible for development and maintenance of facilities at the Research Stations of the Department—includes the Architect's Branch, the Agricultural Engineer Branch (and the decentralized Regional Agricultural Machinery Officer staff), the Plant Inspectors, the responsibility for Public Watering Places in the Western Division of N.S.W., and administration of drought relief.

FOUR AGRICULTURAL COLLEGES; AND A FIFTH DEVELOPING

The Department assumed responsibility for its fourth Agricultural College in January, 1970—the C. B. Alexander College, Tocal, Paterson. Mr G. C. McFarlane is Principal.

The site of what will be the Department's fifth Agricultural College is now being developed at Orange. An objective has been the opening of the inaugural course in 1972, although this might not be achieved. Mr A. J. McKenzie has been appointed Principal and is already stationed at Orange with full-time responsibility for preliminary planning and allied matters. The Orange Agricultural College will provide at tertiary level a two-year Diploma in Farm Management and will be co-educational.

Hawkesbury Agricultural College is now providing courses for five diplomas. The two additionals are the Diploma of Rural Extension (a one-year course; post-diplomate/post-graduate) and the Diploma of Poultry Technology (a two-year course). This year, 1970, marked the first intake of students for each of the two new diploma courses.

AN EDUCATION SECRETARIAT

By implication there is now an Education Secretariat in Central Administration. An Executive Officer (Agricultural Education) position has been established and Mr J. E. Jessup, formerly Executive Assistant to the Deputy Director-General (Research and Education) Dr F. C. Butler, has been appointed. This means now full-time specialized attention to the increasing activities from the Department's responsibility for (shortly) five residential Colleges and *inter alia* seven tertiary-level diplomas (five at Hawkesbury, one at Wagga, and one at Orange).

Some Industry Developments/Trends

CONCERNING LIVESTOCK INDUSTRIES

Sheep Industry's Increased Use of Fleece-measurement and Production-records

Steadily increased use of fleece-measurement in selecting sheep reflects Departmental recommendations. At the 1970 Sydney Ram Sales, two-tooth production-records were featured in a separate sale catalogue for the studs in the fleece-measurement services of the Department and the University of N.S.W. This use of production-records in sheep transactions related to breeding-programmes is a milestone in sheep industry acceptance of production-records as an aid.

Beef Cattle Performance-recording, and Artificial Breeding

Performance-recording as an aid in beef breeding-programmes and in related transactions has increased, as has artificial breeding.

The first Artificial Breeding Centre in this State, exclusively for beef cattle, has opened. It is under private ownership.

Fewer but Larger Poultry Flocks

The total of farms with fewer than 5,000 birds again fell and of farms with more than 5,000 birds again increased; consistent with the trend to fewer but larger units.

A poultry farm-records service has been introduced, to encourage producers to keep records for analysis by officers.

Fewer, but More Efficient Dairy Farm Units

The dairy farm total fell again; by 765 to 9,061—an 8 per cent drop. In one north coast shire the drop was 23 per cent. Total of cows in milk fell by 33,956, to 570,000, but production still compared favourably with the non-drought 1967–68 year. The trend to bigger herds continued; the average is now 63 cows per herd. In whole-milk areas, herds in excess of 200 cows are common.

Bulk-milk collection has again increased; bulk-milk tanks installed increased by 660, to 3,030. Thirty-three per cent of the dairy farms now have refrigerated farm-milk tanks.

Tail-tag Identification of Cattle

By means of a plastic tail-tag bearing a registered number the property of origin of cattle consigned to slaughtering establishments or otherwise sold may now be identified. The scheme, introduced under the Stock Diseases Act, enables carcasses found affected with tuberculosis or other diseases to be traced to the properties from which they came. There was initial widespread non-compliance with the requirements but the scheme is now well established and operating successfully.

Now Eighteen Tuberculosis Protected Areas in lieu of 82 *Quarantine Areas*

The 82 Tuberculosis Quarantine Areas comprising the coastal section have been reclassified as 18 Protected Areas. The change enables individual properties, whereon tuberculosis is found, to be declared as quarantine areas—to provide for tighter control.

Cattle listed in the Protected Areas totalled 700,151 and 540 (0·077 per cent) of these reacted to the test—but 45·6 per cent of the 540 reactors did not show lesions at slaughter. Outside Protected Areas, 59,601 cattle were tested and 1,035 of these were positive. The tail-tag system of identification of properties of origin of cattle led to intensified testing outside Protected Areas.

A new policy has been introduced, requiring the testing of cattle introduced into N.S.W. from known infected herds in other States.

The Mastitis Control Programme

Last year's Report noted the start of the Mastitis Control Programme organized by a Committee representing the Divisions of Animal Industry, Dairying, and Marketing and Agricultural Economics, the Biological and Chemical Research Institute, and the Biometrical Branch of this Department; the N.S.W. Milk Board (now the N.S.W. Dairy Industry Authority) and the University of Sydney.

Phase I of the Programme has now operated for a full year and is providing data basic to a farmer-educational programme.

Bovine Brucellosis Control Programme

Plans for implementation of Phase I of this Programme in the ensuing year have been finalized. The Programme is based on the recommendations of the National Sub-Committee for Control of Tuberculosis and Brucellosis.

Phase I provided for compulsory vaccination of female calves three to six months old. In Tuberculosis Protected Areas all calves will be so vaccinated but elsewhere only calves in known-infected herds.

Phase 2, to start some years hence when the level of infection has been greatly reduced, will comprise large-scale testing and the slaughter of reactors.

Cattle Tick Insecticide-Resistances

The Ridgelands-type resistance by cattle tick to insecticides was confirmed on three properties in the Bonalbo Quarantine Area, and some ticks from one of these properties showed potential for Biarra-strain resistance.

Special quarantine areas had to be gazetted to include all properties whereon known-resistant ticks existed—together with adjoining holdings. An eradication programme was started and will continue for 10 months. It provides fortnightly dippings in dursban, to which the ticks are susceptible.

Eradication proceeded satisfactorily in a special quarantine area previously declared because of Biarra-strain resistant ticks.

CONCERNING FIELD CROPS AND PASTURES

Wheat Quotas Introduced

The New South Wales Wheat Quotas Act became law on 17th October, 1969. The principles of a quota scheme, reflecting production-restriction needs dictated by the world wheat-production wheat-marketing scene, had been put forward by the Australian Wheatgrowers Federation and accepted by the Commonwealth Government earlier in 1969. To each State was left the implementation of the proposals by legislation and management according to the respective circumstances.

A system of intra-State quota-allocations that would be as fair as possible to each wheatgrower was needed; a system that would minimize reasons to appeal for review of allocation. Drafting of the system and methods was delegated to the Grain Elevator Board, with the responsibility to administer the quota scheme. It would be subject of report by that Board and not by the Department of Agriculture.

Widespread anticipation of the pending quota system, though the details were yet to be sorted and clarified, undoubtedly had a reducing-influence on the acreage prepared/sown to wheat for the 1969–70 crop. Seasonal conditions at the seed-bed period, including waterlogging in some areas, also had an affect.

Then, illustrating factors that in any case may uncontrollably intervene and reduce production, came the unusually late frosts in the spring and the stem-rust epidemic (*see the next two notes*).

Worst-ever Frost Damage to Wheat

Unusual, late frosts in 1969 reduced the State's potential wheat crop by an estimated 60 million bushels; about 25 per cent. This doubled the previous record-loss caused by frost (1958–59 season). Head-frosting destroyed some crops. Stem-frosting was significant, but less severe. Yield loss was estimated at 35 per cent in the northern, 25 per cent in the central and 15 per cent in the southern division. The phenomenon underlines the significance of the cold-tolerance studies at Tamworth Agricultural Research Station, relative to the wheat breeding programmes.

Stem Rust Epidemic in Wheat and Oats

Stem rust on wheat and oats in 1969–70 was the worst for many years and, State-wide, caused a loss estimated at 15 million bushels. An unusual feature was that most of the damage was in central and southern districts. Use of resistant wheats minimized the damage in the north.

Festiguay wheat, previously resistant in the field, became susceptible in 1969 to one or more stem rust races in the field. Many crops of the non-recommended Wren wheat, grown in southern irrigated areas in 1969, were badly affected, and this is expected to reduce the future acreage otherwise likely to have been sown to Wren under irrigation.

Hard-Wheat Falcon; Southern Segregation Scheme

Expanded production of Falcon (outstanding amongst the hard-wheats developed in the Department's Southern Wheat-Breeding Programme) has led to the start of segregation of this variety at some of the southern installations of the Grain Elevator Board. This could well be the forerunner of a comprehensive scheme for segregation of hard and soft wheats.

Maize and Grain Sorghum Trends: "Australian Coarse-Grain Growers Association" formed

The record acreage and production of grain sorghum, and the greatest maize acreage for many years past, have been noted elsewhere in this Report—together with the big increase of irrigated acreage of each.

An "Australian Coarse-Grain Growers Association" has been formed by growers, with organized marketing as a major objective. One outcome this year was the export of sorghum and maize; mainly to Japan. The Grain Elevator Board's country silos and its ship-loading facilities at Newcastle handled the maize and sorghum. A 1·5 per cent rail-freight rebate, granted by the Government on sorghum and maize handled for export by the Grain Elevator Board, assisted the grower-returns and encouraged export.

Oilseed Crops Expansion

Establishment of the wheat-deliveries quota system has been accompanied by an upsurge in acreage, dryland and irrigated, sown to oilseed crops. There has been marked increase in acreage of linseed, rapeseed and safflower—predominantly dryland, and of soybeans and sunflowers—generally irrigated.

Whilst the respective acreage is still small, the percentage increase has been big in each case. The indications are that the trend will continue. Growth conditions for winter/spring-growing oilseed crops in 1969 were generally very favourable and these circumstances have helped to encourage further expansion in 1970.

Increasing Confidence in Sub-tropical Pastures

For sub-tropical pastures, 1969–70 was the best season since their seed became available commercially to farmers. Results have been good in dairy farming and beef-raising. The successes, coupled with recovery of pastures that had been badly affected by *Amnemus* weevil, have helped to restore north coast confidence in the introduced species. The revived interest has been accompanied by notable increases in beef cattle numbers, in the trend on the north coast from dairying to beef production.

Australian Plague Locust Outbreak

The predicted big outbreak of plague locusts in central western districts was realized in late 1969, favoured by the spring conditions. Flying swarms appeared in the Coonamble and Dubbo districts from mid-November to mid-December. Flood rains in October hampered ground-control of hoppers, and extensive aerial-spraying of flying swarms was necessary.

There was only marginal increase of the infested area by swarm immigration. The outbreak collapsed in the second, summer generation; in part because of heavy parasitism of the eggs and active stages.

CONCERNING FRUIT AND VEGETABLE INDUSTRIES

Predicted Control of Stone Fruit Brown Rot in the M.I.A.

The longstanding objective of research on brown rot (*Sclerotina fructicola*) of stone fruit in the Murrumbidgee Irrigation Areas appears close to achievement. Control measures in the past have been unreliable. Heavy losses were likely whenever conditions favoured the fungus.

A new systematic fungicide (yet to be registered for use on food crops) has achieved superior control. This, coupled with a disease-weather forecasting service for which preliminary arrangements have been made with the Director of Meteorology (N.S.W.), should enable effective and reliable control.

Controlled Atmosphere (C.A.) Storage of Apples

Of the approximate 3 million bushels cool-storage space for apples in N.S.W., almost one-sixth is for C.A. storage. Departmental research and extension work has shown fruit growers an efficient and relatively inexpensive means of converting cool stores, or parts thereof, to C.A. storage. The method involves use of a prefabricated plastic tent erected inside the store, with a generator and lime-scrubber unit. This year many units were installed. There is notable interstate and overseas interest in this development.

Aerial Spraying of Bananas, against Leaf Diseases

This year, 18 per cent of the banana acreage in N.S.W. was sprayed from the air to control Sigatoka (leaf spot). The aerial spraying has been very satisfactory on most areas, against Sigatoka, but its suitability for control of leaf speckle is in doubt.

Banana Marketing

The banana industry now has a Banana Marketing Control Committee, to examine marketing problems and proposals. The Committee is a result of a poll of banana growers conducted this year. The poll followed proclamation of the Banana Industry Act, and Regulations under the Act, in October, 1969.

Citrus Trees: Mechanical Hedging to Control Size

Mechanical hedging of citrus trees to control size is increasingly important because of the rising costs of harvest-labour. Trials of various tree-shapes are proceeding at the Dareton and Yanco Research Stations. A central coast field day showed growers the principles and was followed by a notable increase of tree-hedging throughout the District.

Apple Trees: Training and Planting Density

Growers are being shown new methods of pruning; methods appropriate to higher-density plantings of smaller and more easily managed trees; methods replacing those that resulted in the conventional vase-shaped trees of the past.

Predicting Citrus Rootstock-Scion Compatibility

A bark ring-grafting method to predict citrus rootstock-scion compatibility, by micro- and macroscopic examination of the graft union, has shown potential. This could be an important development, because some incompatibilities between scions and newly developed rootstocks have taken as long as 10 to 12 years to show up under field conditions.

Wine Grape Plantings

Keen interest has continued in the establishment of new vineyards and expansion of existing plantings. In the past two years the total of wine grape acreage has increased by one-third; to 12,827 acres.

Awareness of the value of improved planting-material has been created in all districts; in fact the demand for improved clones cannot be satisfied by the present level of availability. Growers and nurserymen are being encouraged and assisted to select cuttings from only high-producing and disease-free vines; and selected clones of the more sought varieties are being multiplied.

Fruit Fly Suppression

Isolated incidence of Queensland Fruit Fly occurred at Narrandera and Deniliquin and led to imposition of restrictions on fruit exports, but immediate action to suppress the pest there appeared to have succeeded.

Fifty-five towns are now in the Whole-Town Treatment Scheme and the evidence is that the treatments, properly applied, have suppressed the pest there.

Microbiological Antagonists in the Soil

This study was initiated in 1969 during the visit of Dr K. F. Baker, Professor of Plant Pathology, Berkeley, California. A growth-room has been installed at the Biological and Chemical Research Institute for the study of biological control of root pathogens. The installation has been financed in part by the N.S.W. Division of the Australian Nurserymen's Association.

Virus Disease Complex in Mushrooms

The presence of four different virus particles has been detected in infected mushrooms. One of these appears to be a previously unrecognised particle.

Virus contamination has been eliminated from one line of commercial mushroom spawn. A search for possible sources of virus infection in fungi related to the cultivated mushroom, particularly wild basidiomycetes, has revealed virus particles in one species (*Laccaria amethystina*).

Speedier Composting for Mushroom Industry

Research into composting methods has shown that by using manufactured enzymes the time needed to produce good quality compost can be greatly reduced, and this means that more mushroom crops may be grown in a year.

Regeneration of French Bean Industry in N.S.W.

In recent years the French Bean Industry (processing) had shifted to southern States, because of the effect of "summer death" disease on production of French Beans in N.S.W. The trend is now reversing; a significant change having occurred in the past year.

Several varieties of French Bean resistant to "summer death" have been selected, from more than 100 lines imported from the U.S.A. and Europe. Seedsmen and processors have been active in this matter, as well as the Department's research services. The selected, resultant varieties include some that have other desirable features—agronomic and processing. The results of the programme are helping to regenerate the industry in this State.

Two New Tomatoes, from Yanco, for Canning Industry

Two tomatoes bred at Yanco Agricultural College and Research Station especially for the canning industry have been released, as "YRF No. 2" and "YRF No. 3". They resist *Fusarium*-wilt, skin-cracking and blossom end rot, and are free from green shoulder. Their small bush character and concentrated fruit-set make them very suitable for mechanised or hand harvesting.

Finance–Summary

Consolidated Revenue Fund Expenditure and Receipts.—Expenditure from Consolidated Revenue Fund was $17,612,440.64. This included $2,601,751 for Cattle Tick Control and $636,355 for upkeep of the Royal Botanic Gardens, Centennial Park and Admiralty House, part cost of which is recouped from the Commonwealth Government.

Expenditure by other Government Departments on behalf of the Department of Agriculture is shown in the Public Accounts, tabled in Parliament as an accompaniment to the Report of the Auditor General.

Receipts on Consolidated Revenue Fund were $3,676,261 and these are shown in detail later, in this Report's *Appendix I*—"The Accounts of the Department of Agriculture 1969–70".

Capital Works.—Capital works were constructed and certain property acquired from General Loan Funds to the value of $1,520,000—details are contained in this Report's *Appendix I.*

Trust Funds.—Funds provided by industries, semi-Governmental bodies, Commonwealth Government grants and specialized taxations continue to rise. Substantial sections of the Department of Agriculture's research programmes and projects have been financed by these funds—and the findings made available to primary producers and others.

Receipts and expenditure from the foregoing trusts and grants are recorded through the "Special Deposits Accounts" at the Treasury. Expenditure from these is regulated either by Act of Parliament or by such directions as may be given by the donor body, to whom the Department of Agriculture must account at the close of the financial year.

Some of the more important aspects of the operations on the Special Deposits Accounts are given in this Report's *Appendix I.* (See also the "Research Co-ordination Office", page 22, and "DIVISION OF RESEARCH STATIONS", page 24.)

Commonwealth Extension Services Grant (C.E.S.G.)

Throughout this Report there are mentions illustrative of ways whereby the C.E.S.G. is helping and enhancing the extension services and allied applied research services of the various Divisions/Institutions of the Department.

The Chief of the Division of Extension Services is responsible overall to the Director-General for administration of the C.E.S.G. funds. He has included (page 242), in the DIVISION OF EXTENSION SERVICES part of this Report, a listing (per Project No.) of the 1969–70 allocations. In total, the Department was allocated $1,078,011 from the C.E.S.G. for 1969–70, as against $918,046 in 1968–69 and $757,100 in 1967–68.

Research Administration/Co-ordination Office

Research Co-ordinator Mr K. E. Hutton attended the 19th Government Administrative Staff Course of the Institute of Administration, University of New South Wales.

OVERSEAS STUDY TOURS AND POST-GRADUATE STUDIES BY RESEARCH STAFF

The Department continued a vigorous study-leave policy. Some 10 per cent of the 365 research workers were on post-graduate study-leave at Australian or overseas universities; and 3 per cent were on official study-tours overseas. Fifteen per cent had registered portion of their Departmental research project(s) with Australian universities as external studies towards a Masters Degree.

The Department also maintained its training programme with the CSIRO. The Wool Research Trust Fund enabled eight officers, and the Australian Meat Research Committee Fund one officer, to work on approved projects with CSIRO research teams. This period of post-graduate training is of two or three years duration in most cases.

RESEARCH GRANTS FROM INDUSTRY AND COMMONWEALTH FUNDS

The main research grants from various Industry and Commonwealth funds to support the Department's research programmes are summarized in the following tabulation, with comparative figures from the past three years. Additional minor grants came from various Industries for specific items.

Source	1967–68	1968–69	1969–70	Totals
	$	$	$	$
Commonwealth Extension Services Grant (Estimate of Research Component)	277,200	559,941	594,101	1,431,242
*Industry/C.E.S.G. Special Research Fund	....	....	43,600	43,600
Wheat Industry Research Committee of N.S.W.	85,980	105,588	155,315	346,883
Wheat Industry Research Council	97,696	51,106	71,607	220,409
Wheat Industry Stabilisation Fund	85,493	8,350	4,500	98,343
Australian Meat Research Committee	152,705	158,598	140,187	451,490
Wool Research Trust Fund	110,699	159,611	274,550	544,860
Australian Wool Board Post-Graduate Scholarships	10,871	16,520	19,200	46,591
Australian Dairy Produce Board	65,998	65,944	63,557	195,499
Banana Research Advisory Committee	10,300	9,900	9,250	29,450
Honey Research Advisory Committee	2,800	....	....	2,800
Tobacco Industry Trust Account	36,410	77,760	54,520	168,690
Australian Apple and Pear Board	8,200	10,420	....	18,620
Spray Residues Research (Commonwealth Grant)	11,100	....	....	11,100
Council of Egg Marketing Authorities of Australia	....	....	12,710	12,710
Totals	955,452	1,223,738	1,443,097	3,622,287

* Grants from the Rice ($15,000), Mushroom ($3,500), Citrus ($1,000), and Bean ($2,300) Industries matched equally by the C.E.S.G. Special Research Fund.

These grants effectively support the basic State contribution to the Department's research and enhance the Department's research capacity. At the 1969–70 level of support these grants comprised about one-third of the Department's total expenditure on research for the year.

NEW PROJECTS INITIATED WITH INDUSTRY AND COMMONWEALTH FUNDS

The major part of the industry grants received in 1969–70 were for continuation of the existing research programme but also the following new projects were approved and initiated because of them.

Australian Wool Board

Agricultural Research Station, Glen Innes.—Development of aerial pasture improvement: Techniques for the northern tablelands of N.S.W., $9,100.

Division of Plant Industry (*in conjunction with CSIRO, Canberra*).—Training of a research agronomist via a study of the autecology of galvanised burr (*Bassia birchii*) in northwestern N.S.W., $5,815.

Research Agronomist (*Forage Ecology*).—Training with the CSIRO Division of Plant Industry, Canberra, $4,665.

Division of Plant Industry (*in corjunction with University of New England, Armidale*).—Training of a research agronomist via a study of the ecology of annual weeds of pastures, $3,015.

Division of Animal Industry (*in conjunction with the CSIRO Division of Animal Physiology, Prospect*).—Post-partum mating of sheep, $21,590.

Biological and Chemical Research Institute, Rydalmere.—A study of factors influencing nodulation of legumes, survival of Rhizobia in soil, and effectiveness of rhizobial strains, $64,790.

Agricultural Research Station, Trangie.—Replacement of post-graduate scholar (B. J. McGuirk), $4,000.

Australian Meat Research Committee

No new beef project was supported but the following mutton and lamb new projects were initiated.

Agricultural Research Station, Trangie.—DAN 5S—Facilities for carcass investigations, $19,000.

Agricultural Research Station, Tamworth.—DAN 6S—Evaluation of pasture and forage species in terms of animal production in the northwest, $4,100.

Division of Animal Industry (in conjunction with the CSIRO, Canberra).—DAN 7S—Integration of crop and animal production, $8,330.

Wheat Industry Research Committee of New South Wales

Agricultural Research Station, Tamworth.—Equipment for breeding for frost resistance, $20,500.

Agricultural Research Institute, Wagga Wagga.—Continuous cropping in southern N.S.W., $13,575.

Wheat Industry Research Council

Agricultural Research Station, Tamworth.—Provision of auto-analyser for agronomic and soil studies, $10,400.

Agricultural Research Institute, Wagga Wagga.—Travel grant for integration of wheat research, $800.

Wheat Industry Stabilisation Fund

Agricultural Research Institute, Wagga Wagga.—Lysimeters for drought resistance studies in wheat, $4,500.

Australian Dairy Produce Board

Hawkesbury Agricultural College, Richmond.—Visit to South East Asian recombining plants, $1,200; Dairy detergency, $4,115; and Relationship between chemical composition and cheese grading, $3,685.

Council of Egg Marketing Authorities of Australia

Division of Marketing and Agricultural Economics.—An evaluation of supply control measures in the egg industry, $2,710.

Veterinary Research Station, Glenfield.—Development of a specific pathogen-free flock, $10,000.

Commonwealth Extension Services Grant (C.E.S.G.)

This finance was channelled in part to improve the research facilities at many of the central laboratories and decentralized research centres. Some major allocations for 1969–70 were:

Biological and Chemical Research Institute, Rydalmere.—Electron microscope ancillaries, $13,468; and a plant growth chamber, $4,012.

Agricultural Research Station, Wollongbar.—Laboratory construction (phase II), $412.131

Agricultural Research Station, Grafton.—Equipment for beef cattle grazing experiment, $8,914.

Agricultural Research Station, Orange.—Controlled atmosphere units for potato storage research, $4,660.

Agricultural Research Station, Tamworth.—Electronic calculator, $4,057.

C.E.S.G.—"Special, Research and Other Services" Grant

This component of the C.E.S.G. is used to match State and/or Industry contributions for research projects in rural industries that do not have legislated, research schemes. These new projects equally financed by Industry and the C.E.S.G. Special Research Fund were initiated this year:

Horticultural Reseach Station, Narara.—Citrus rind blemish research (Central Coast Agricultural Research and Extension Committee contribution $1,000), $2,000.

Biological and Chemical Research Institute, Rydalmere.—Bean disease research (Australian Bean Research Group contribution $2,300), $4,600.

Agricultural College and Research Station, Yanco.—Rice research (Rice Industry Co-ordination Committee contribution $15,000), $30,000.

NEW PROJECTS INITIATED WITH STATE FUNDS

Thirty-four new projects were approved in 1969–70:

Division of Plant Industry

Investigation of poor pasture productivity and pasture establishment failures—Albury district; Effect of stocking rate on pasture and animal production from a Jemalong Barrel Medic pasture; Cloud seeding research; and Survey of weed problems on the north coast of N.S.W.

Division of Horticulture

Citrus rootstock/scion incompatibility investigations: Causes and control of rind blemish of citrus; Effect of T.I.B.A. sprays on branch angles in apple trees; Tree training method, rootstock and variety trial; Trickle irrigation trial, apples; Maturity studies, granny smith apples; Pear rootstock trial at Orange; Pome fruit variety and seedling collection; Pome fruit variety collection; Crop regulation in dessert stone fruit, coastal districts; Cherry arboretum; Herbicide management trial in canning peaches; Peach tree pruning for mechanical harvesting; Comparative irrigation trial in peaches; Apricot rootstock trials, M.I.A.; Banana nutrition, pot trial; Vine spacing trial in black shiraz; Nematode-resistant grape rootstock trial; Testing of semillon clonal selections; and Testing of black shiraz clonal selections.

Division of Dairying

Jen-Sal detergent project.

Division of Animal Industry

Nutrient requirements of turkeys; Physical form of broiler diets; Environment control in broiler nutrition; Dairy beef production; Tropical pasture species' properties which affect cattle production; Selective breeding of dorset sheep for production characters; Post-partum mating of sheep; Selective breeding of border Leicester sheep for production characters; and Avian respiratory diseases.

Research Scientist Classification

This classification was initiated into the Public Service of New South Wales in the preceding year, to provide special personal salary for the research worker of exceptional calibre who may prefer to continue to specialize in research rather than enter the administration field to progress beyond the limits of the reseach salary range.

Of 16 officers of the Department's research services interviewed by the Public Service Board's Qualifications Committee, one was admitted to Senior Research Scientist classification, and four to Research Scientist classification. In accordance with the system, the five were transferred to a special seniority Department in the office of the Public Service Board and seconded back to the Department of Agriculture.

Automatic Data Processing (A.D.P.) Section

Fruit Tree Census.—The first stage of an A.D.P. system for calculating and reporting the results of a census of fruit trees was completed in May, 1970. The census was taken as at 31st December, 1969. Reports produced show the number of growers, and the number and acreage of trees, vines, etc.: bearing and non-bearing and by kind, by age, by variety, within shires and fruit growing districts, and for the whole State. Bananas, and fruits in the M.I.A. are not yet in the system but will be incorporated for the next census.

Beef Cattle Performance Records.—The A.D.P. system for beef cattle performance recording has been completed in accordance with original specifications for the project. Some modifications and extensions are to be incorporated in the system following recommendations from a committee representing all States and the Commonwealth; a committee to develop a standard set of computer programmes, for Australia-wide use, for analysis of beef cattle preformance records.

Plant Diseases Herbarium Service.—Programming of a system to record, index, catalogue and retrieve information from the Plant Pathology Herbarium maintained at the Department's Biological and Chemical Research Institute, Rydalmere, has started. The system is expected to provide information needed for all types of plant disease investigation; including identifications, incidence, distribution, etc.

Dairy Herd Recording Data.—Re-programming of the Dairy Herd Recording system, necessitated by a change in computing equipment, is continuing. Some 180 programmes, developed for the Treasury's H–400 computer, are to be rewritten in COBOL for the recently installed H–8200 computer.

Training Courses.—Eighteen Departmental officers this year attended A.D.P. training courses conducted by A.D.P. Service Bureau at the Treasury.

DIVISION OF RESEARCH STATIONS

(former "Research Stations Branch")

General

RE-NAMING

The former Research Stations Branch is now designated Division of Research Stations.

NEW POSITIONS/DUTIES

Mr N. K. Golding, formerly Chief of the Research Stations Branch is Chief of the Division. A Deputy Chief position has been established, and Mr G. A. Crawford, formerly Principal Agronomist (Miscellaneous Crops), Division of Plant Industry, has been appointed to it.

For *the Architect Section* two new positions were created—Architect Grade II and Technical Officer Grade II. These when filled will enable the Division to go closer to meeting the increasing demands for capital- and maintenance-works at the Department's institutions.

For *the Engineering Section*, a position of Senior Agricultural Machinery Officer has been approved. This when filled will increase the effectiveness of the Agricultural Engineer, by reducing his personal supervision and guidance of field officers in the Agricultural Machinery Advisory Service. The Agricultural Engineer's attention to research and extension policy, and general administration of the Section will be facilitated.

In the Agricultural Machinery Officer establishment, two new positions have been established; one for an Agricultural Machinery Officer to be located at headquarters of the Northern Agricultural Region, Tamworth, and the other at Mid Western Agricultural Regional headquarters, Cowra. The two new positions, and transfer of the Agricultural Machinery Officer, South Western Region, Leeton, to the new position of Senior Agricultural Machinery Officer, Sydney, have created three vacancies in what is a difficult staff-recruitment area.

In *the Plant Inspection Section* some re-organization has been effected. The Plant Inspector positions are now under the immediate control of the Agricultural Engineer. One Plant Inspector has been re-classified as Agricultural Machinery Officer, to deal with agricultural machinery; one is specific to instrumentation matters; and the third Plant Inspector will deal with plant and equipment generally, and motor vehicle matters in particular.

At *the Research Stations*, the research staff of subject-matter Divisions has increased such that this Division's responsibility to provide ancillary staff is increasingly onerous. Some progress was made this year by establishment of 20 new positions: a typiste, a technical officer (scientific), two research assistants, 10 field assistants, a cereal technician, a leading hand, and four farmhands.

Some positions/duties at some Research Stations have been re-organized to meet the trends of research and this is on request by some of the other Stations. At Trangie two field assistant positions were re-classified to stock assistant, and re-classification of three laboratory assistants to research assistants has been sought. At the Seven Hills and the Tamworth Station a field assistant has been re-classified to research assistant. Overall, the trend of the last three years—to employ assistants who are usable in the field *and* the laboratory—is increasing.

A Manager was appointed to the Agricultural Research Station, Orange, but was transferred to the vacant Managership at Leeton. Transfer of the Temora Manager to Wollongbar and the Wollongbar Manager to Orange, and a new appointment to Temora, were foreshadowed at the close of 1969–70.

Another significant development was establishment of a position of Assistant Manager at the Agricultural Research Station, Trangie, one of the larger research places. This is the first such position; created to meet the expansion of administrative and supervisory work at the larger research institutions but also to provide a training-reservoir of future Research Station Managers to meet losses.

In respect of *the Western Division Public Watering Places*, there were previously 10 labourers, under the control of the Supervisor of Public Watering Places. The group has been re-organized; to comprise the Supervisor, two Assistant Supervisors, and four field officers. The re-organization may enable recruitment of employees to suit the work and to provide trained supervisors to continue the services efficiently as senior personnel depart.

PROGRESS TOWARDS AN AGRICULTURAL ENGINEERING CENTRE

Establishment of an Agricultural Engineering Centre, at Glenfield, was mentioned in last year's report. Progress has been made. The Centre should be available for occupation by September or October, 1970

Staff positions for the Centre have been approved. Currently, applications for an Engineer and a Draughtman position are being sought. The Workshop Manager, tradesmen (2) and office assistant positions will be filled when the building has been completed.

The Centre has been designed to investigate farm mechanisation and engineering problems; to provide a plans service for landholders; to make specialised equipment for the Department's research workers and provide maintenance of research instruments/equipment. The Centre will improve the Department's research potential overall, as well as the Agricultural Engineering Section's own services to the farming community through engineering and mechanisation research.

Property Improvement at the Institutions

CAPITAL WORKS PROGRAMME

Overall

The Department's capital works programme continued to expand and this year mounted an expenditure of roundly $3,315,000; some $1,930,000 more than the previous year's total. The works were financed from: General Loan Account, $1,020,000; States' Grants (Advanced Education) Act, $964,727; States' Grants (Technical Training) Act, $739,706; Commonwealth Extension Services Grant, $464,000 (approx.); Industry and Other Funds (approx. figure), $126,000.

Major Works Completed or Almost Completed

At Wollongbar the Regional Research laboratory and office complex ($590,000); at Glenfield Veterinary Research Station the drought-feeding laboratory and sheep house ($90,000); at Hawkesbury Agricultural College, new residential accommodation ($208,000) and dining room and kitchen facilities ($240,000); at Wagga Agricultural College, new residential accommodation ($413,000); and at Yanco Agricultural College and Research Station, new residential accommodation ($295,000).

Works Commenced

At Condobolin Agricultural Research Station, the office and laboratory ($370,000); at Glenfield Veterinary Research Station, the Agricultural Engineering Centre ($65,000); at Seven Hills Poultry Research Station, the laboratory and administrative building ($282,000); at Hawkesbury Agricultural College, the Animal Husbandry Unit ($142,000) and the physics laboratory and lecture room ($212,000); and at Wagga Agricultural College, the animal and plant science laboratory ($331,000).

The continuing extensive programme has placed heavy work loads on the Division in general and the Architect's Section in particular. Some works that would usually be handled by this Department had to be referred to the Department of Public Works for attention. These included the sheep demonstration unit, show barn and dairy building at Wagga Agricultural College; the pig farrowing houses at the Wollongbar Agricultural Research Station, and the administrative building at Seven Hills Poultry Research Station.

With General Loan Account Funds

In addition to the normal loan allocation, $500,000, special allocations totalled $520,000. In the latter were funds ($150,000) associated with acquisition of C. B. Alexander College, Tocal.

Jobs undertaken or in progress with funds from General Loan Account were:

	Estimated Cost	Expenditure 1969–70
	$	$
Condobolin Agricultural Research Station—		
Laboratory and administration building	371,500	28,223
Foreman's store	10,974	10,974
Machinery shed	10,762	10,762
Glenfield Veterinary Research Station—		
Steam raising plant and autoclaves	27,552	904
Laboratory and conference room	513,542	54,424
Seven Hills Poultry Research Station—		
Laboratory and administration building	282,000	58,857
Broiler houses (two)	37,996	37,143
At Research Stations, Agricultural Colleges, etc.—		
Eighteen cottages	285,730	256,500
C.B. Alexander Agricultural College—		
Acquisition expenditure	520,000	150,000
Narrabri Agricultural Research Station—		
Acquisition of land	200,000	200,000
Trangie Agricultural Research Station—		
Irrigation development	62,032	39,892
Alstonville Tropical Fruit Research Station—		
Extensions to office	43,771	43,771
Dareton Horticultural Research Station—		
Alternative irrigation supply	34,760	34,760
Wollongbar Agricultural Research Station—		
Power reticulation	35,737	35,737
Growing sheds for pigs	26,689	19,597
Equipment for research laboratory	50,000	38,335
Royal Botanic Gardens—		
Glasshouse	91,000	121
Rydalmere Biological and Chemical Research Institute—		
Controlled-environment room	18,500	....
	2,622,545	1,020,000

With States' Grants (Technical Training) Act Funds

The 1969–70 expenditure of $739,706 from the States' Grants (Technical Training) funds at Hawkesbury, Wagga and Yanco Agricultural Colleges comprised $44,398 in respect of the first triennium programme and $695,308, from the second triennium.

The programme for the first triennium has been completed except for the approximate $8,000 expenditure item concerned with steam line from the dairy to the kitchen, and additional offices and laboratories (animal husbandry unit), at Hawkesbury Agricultural College. For the second triennium the programme comprises works to the extent of $1,227,000 and, except for some minor items, the construction is well advanced on all.

Details of expenditure for the 1969–70 programme are:

	Estimated Cost	Expenditure 1969–70
	$	$
1st TRIENNIUM WORKS—		
Hawkesbury Agricultural College—		
Steam line from dairy to kitchen	44,140	39,140
Additional offices and laboratory	80,538	1,142
Science laboratory	197,716	404
Wagga Agricultural College—		
Engineering and farm demonstration unit	65,985	1,998
Extensions to the Graham Block	279,293	1,714
Totals	667,672	44,398
2nd TRIENNIUM WORKS—		
Hawkesbury Agricultural College—		
Miscellaneous plant, teaching aids, machinery	28,648	21,321
Bull yards	3,808	3,608
Animal husbandry unit—Stage II	136,284	47,759
Physics laboratory and lecture room	211,875	44,896
PABX switchboard	19,000	....
Meat production storage—demonstration centre	25,214	6,134
Omnibuses (two)	26,540	26,540
Beef cattle centre	18,354	8,634
Agricultural machinery shed	13,327	13,327
Wagga Agricultural College—		
Livestock demonstration room	51,042	23,300
Erection of dairy buildings		22,306
Animal and plant science laboratory	303,750	196,279
Miscellaneous plant and equipment	9,810	104
Piggery section	90	....
Modernisation of orchard section	14,461	14,461
Yanco Agricultural College—		
Accommodation block	294,594	261,378
Miscellaneous plant, equipment, teaching aids	12,000	5,261
General—		
Advance planning	6,571	....
Totals	1,175,368	695,308
TOTALS FOR 1st and 2nd TRIENNIUMS	1,843,040	739,706

With States' Grants (Advanced Education) Act Funds

All works in connection with the first triennium were completed, with expenditure of $585,723 this year bringing the total expenditure for the triennium to $800,930.

Under the States' Grants (Advanced Education) Act of 1969 the Department received a total allocation of $4,844,000 of "matched" grants.

During the 1969–70 fiscal year $370,504 was expended on "Works in Progress" and $8,500 on "Completed Works" in connection with the second triennium; a total expenditure, from both trienniums, of $964,727. Details of 1969–70 programme are:

	Estimated Cost	Expenditure 1969–70
	$	$
1st TRIENNIUM WORKS—		
Hawkesbury Agricultural College—		
Tutorial block	52,002	50,094
Erection of poultry section	31,112	30,487
Equipment and furniture	38,195	38,195
Dairy Tech. laboratory, lecture room	51,202	2,886
Residential accommodation	114,260	109,226
Orange Agricultural College—		
Development survey	1,937	1,937
Wagga Agricultural College—		
Animal and plant science lab.—Stage I	21,290	21,290
Augmented water supply	571	571
Boiler, hot water mains	5,000	5,000
Development plans	1,827	1,027
Dining room and kitchen	114,291	89,391
Equipment and furniture	37,108	29,290
Residential accommodation	284,277	202,059
Sports facilities	9,801	4,270
Totals	762,873	585,723
2nd TRIENNIUM WORKS—		
Hawkesbury Agricultural College—		
Tutorial block	246,198	39,408
Demolition of site works	31,462	....
Erection of poultry section—Stage II	76,000	16,919
Residential accommodation—Stage II	93,908	79,891
Alterations to Dairy Technical building	33,000	....
Equipment	38,500	219
PABX switchboard	23,092	99
Wagga Agricultural College—		
Dining room and kitchen	227,000	96,759
Residential accommodation	129,065	....
Boiler and hot water mains	56,600	131,179
Animal and plant science laboratory	19,500	5,980
Equipment	21,000	50
Irrigation bore	8,500	8,500
Totals	1,003,825	379,004
TOTALS FOR 1st and 2nd TRIENNIUMS	1,766,698	964,727

With Commonwealth Extension Services Grant (C.E.S.G.) Funds

All capital works undertaken with C.E.S.G. funds were designed and supervised by the Architect's Section of the Division. The $590,000 Regional Research Laboratory and office at Wollongbar Agricultural Research Station, and the $90,000 Drought-feeding Laboratory and Sheep House at the Veterinary Research Station, Glenfield, were virtually completed by the end of June, 1970.

Specifically the *jobs completed or almost completed* in 1969–70 were:

	Estimated Cost $
Wollongbar Agricultural Research Station—	
Regional laboratory and office complex	590,000
Pig farrowing shed	18,800
Glenfield Veterinary Research Station—	
Parasitology laboratory	31,200
Orange Agricultural Research Station—	
Potato evaluation room	2,900

The following works *were started* in 1969–70:

	Estimated Cost $
At Glenfield—	
Agricultural Machinery Centre	87,350
At Rydalmere—	
Mill room modifications	10,000

With Industry and Other Funds

Capital works financed from "Industry and Other Funds" were wholly designed and supervised by the Architect Section of the Division. The following works *were completed* in 1969–70:

	$
At Glenfield Veterinary Research Station—	
Drought-feeding laboratory and animal house	90,000
At Glen Innes Agricultural Research Station—	
Heating of tobacco glasshouses	5,900
Tobacco storage building	4,700
Lismore Board of Tick Control—	
Extensions to laboratory (except for air conditioning)	39,800

Work *has commenced* on the $16,180 quarantine glasshouse at Tamworth Agricultural Research Station and the $23,900 facilities for carcass investigations at Trangie Agricultural Research Station.

MAINTENANCE WORKS AT THE RESEARCH INSTITUTIONS

The maintenance and allied work on buildings and associated structures included cottage renovations (nine cottages) at Trangie, Leeton, Bathurst, Glen Innes, Grafton, and Narrabri; erection of machinery sheds at Cudgel, Wollongbar, and Condobolin, a steel-framed poultry-cage house at Seven Hills, and a potting shed and extensions to the fruit packing shed at Alstonville; conversion of storeroom and office to laboratory and entomology room respectively at Bathurst; provision of a laboratory in the agronomy building at Condobolin, renovations to offices, including space-heating, at Glen Innes, a garage at Wollongbar, and air-conditioning of the pathology glasshouse at Tamworth.

Expenditure on this work at Research Stations—including general electrical repairs and additions and minor building-maintenance work, totalled $69,000.

The Division also carried out $25,000 worth of maintenance on re-roofing and painting of the Dairy Technology building at Hawkesbury Agricultural College and three new garages at Wagga Agricultural College.

Some building maintenance works provided for in the 1969–70 funds were not completed. Among these were works at Tamworth, Cowra, Temora, and Griffith. But the uncompleted works are relatively insignificant by comparison with those that are needed but could not have been undertaken without more staff and more funds—estimated at about $125,000 worth. This very real backlog of maintenance work and the approximate $220,000 needed for additional works (the current annual occurrence-rate of essential maintenance works) comprise an "arrears-prospect" that is assuming formidable proportions when related to the Division's Architect Section staff-strength and recent financial appropriations.

ACQUISITION OF LAND FOR THE INSTITUTIONS

At Narrabri.—Negotiations were completed for purchase of an additional 400 acres for the Agricultural Research Station, Narrabri. This will increase the potential there—with emphasis on cotton, oil crops, and irrigated pastures.

At Glen Innes.—At the Agricultural Research Station, Glen Innes, an adjacent eight-acre reserve, used many years ago as a school area, was gazetted for Research Station use.

At Cudgel, M.I.A.—Permissive occupancy on Farm 1567, Cudgel (four miles south, by road, from Yanco Agricultural College and Research Station) was secured on 8th September, 1969. This area, 90 acres of light soil, is to be developed over 15 years as a citrus demonstration orchard. The research and extension findings will be applicable to other similar horticultural areas, such as those of the Coleambally Irrigation Area.

At Grafton.—Negotiations continued for leasing of 420 acres at Fineflower, Grafton; to assist in the expanding beef cattle research programme at the Agricultural Research Station, Grafton. The first grazing-experiment is expected to commence on this site in the late summer/early autumn, 1970–71.

RESEARCH STATIONS IMPROVEMENTS:
OTHER THAN THE CAPITAL WORKS PROGRAMME

Fencing

Expenditure on fencing was $34,000, as against $15,000 in 1968–69. A major item was the total of 15 miles of intensive subdivision fencing erected at Wollongbar, Tamworth, Condobolin and Cowra Stations to meet the expanding needs of research. All Stations shared in the eight miles of internal fencing renewed or renovated. Trangie, Dareton, Seven Hills, Grafton and Wollongbar Stations shared the total of four miles of boundary fencing.

Roadworks

Near to $55,000 was expended on roadworks. The work provided extensions and up-gradings of Station approaches, the surrounds to administrative and laboratory areas, and internal roadways. Bitumen sealing was done at 12 Stations, and roadworks were extended at Grafton, Alstonville, Condobolin and Narara.

Aesthetic Improvements

Station entrances, approaches, and the surrounds to buildings gained from the aforementioned roadworks programme. Lawn and garden establishment and general landscaping for the surrounds of new administrative and laboratory buildings further enhanced the appearance of Stations.

Flood Mitigation and Earth Works

Annual, soil conservation measures were fulfilled at Cowra and Tamworth at a cost of $600; at Temora, $2,270 was expanded on three soil conservation projects; at Wollongbar $2,000 and at Glen Innes $400 were expended on work of this sort. In all, the outlay on soil conservation work for the year was $5,270.

Water Supply and Irrigation

Expenditure totalled $47,670. Stock- and domestic-water supplies were extended at Tamworth, Narrabri, Grafton, Wollongbar and Alstonville Research Stations. Major irrigation developments took place at Trangie, Dareton, Cudgel and Tamworth.

At Trangie.—Development of an irrigation area of 500 acres has progressed. In light of the soil survey done by the Chemistry Branch in 1968–69, the 1969–70 work involved clearing, surveying and levelling. The developmental costs totalled $60,684 at the close of the fiscal year, including membership-fee ($32,850) of the Trangie-Nevertire Irrigation Scheme. Of the $60,684, three-quarters was from General Loan funds and one-quarter from Consolidated Revenue fund.

Work to complete the irrigation scheme will cost an estimated additional $24,000; to include deep ripping, land planing, the installation of ditches, drains, roads, concrete structures, and the extension of the electricity supply to connect two large-lift pumps.

At Dareton.—An alternative irrigation-water supply incorporating a 10-inch rising main from the Murray River was completed at a cost of $34,760, from General Loan funds. This will alleviate the problem of rostered receival of irrigation water from the District irrigation system. Rostering was unsatisfactory for research purposes.

At Tamworth.—An irrigation bore was developed on the recently acquired 200-acre Breeza Sub-Station. Equipping the bore is now proceeding, as are the land survey and final development for irrigation.

At Yanco Agricultural College and Research Station.—Some additional underground irrigation mains were installed. Also, at the recently acquired Cudgel Citrus Demonstration Orchard, there were similar installations preparatory to initial tree-plantings in September, 1970.

Land Clearing and Development

Work undertaken at Trangie, Condobolin, Grafton, Cudgel, Narara, Seven Hills and Orange aggregated 2,000 acres and a $15,833 expenditure. Ten acres of previously tidal-affected land on the Duck Creek section of the Wollongbar Agricultural Research Station was reclaimed, and brought into productive grazing.

Machinery, Equipment, Motor Vehicles, Stores, etc.

Machinery and Equipment.—A sum of $155,850 from Consolidated Revenue fund was expended to purchase equipment, apparatus and machinery.

General-purpose items purchased included combines, tractors (14), auto harvesters, rotary hoes, excavating back-hoes, fertilizer distributors, hay balers and rakes; to a total value of $100,000.

Plant purchased specifically for research included a spectrophotometer, pH meters, autoclaves, colorimeters, scales and balances, a centrifuge, gas chromatograph parts, spray units, a grinding mill, a fruit grader, microscopes, deep freezers, a fume cabinet, a deioniser, a ribbon blender, air conditioners and a single-row cotton picker; totalling some $56,000.

Grants also were received from Industry funds for material, plant and equipment for research projects at the Research Stations.

The Division of Research Stations also helped the Colleges, the Agricultural Research Institute, Wagga, the Veterinary Research Station, Glenfield, the Biological and Chemical Research Institute, Rydalmere, and the Royal Botanic Gardens, to select and purchase machinery, apparatus and equipment.

Motor Vehicles.—Forty-eight vehicles were replaced and 52 additional motor vehicles, ranging from very small sedans and Mini Mokes to trucks and buses, were delivered.

Acquisition of the C. B. Alexander Agricultural College at Tocal also added 11 motor vehicles to the Department's fleet. The Department's fleet now totals 324 vehicles.

Stores, Minor Plant, etc.—Stores, minor plant and equipment, repairs to plant and equipment and other essential services for Research Stations and the Yanco Agricultural College and Research Station totalled $220,000; $17,000 more than in the previous year.

Operational Activities at the Stations

SEED AND FODDER PRODUCTION, AND USE

Seed

Winter Cereal Seed.—Winter cereal pure seed harvested at Research Stations (3,025 bushels of wheat, oats, barley and cereal rye) again met Departmental needs for domestic crop-production.

Barrel Medic Seed.—The Agricultural Research Station, Condobolin, produced 21,400 pounds of Jemalong strain, barrel medic seed. At 285 lb/acre the yield demonstrated to the District the potential for pasture seed production. The seed is being utilized to extend Research Station pasture sowings at Condobolin and Trangie in particular, and for intra-Departmental distribution for pasture research.

A Small-plot Pasture Seed Harvester.—A pasture-pod suction-harvester for use in small plot pasture research work was successfully developed at the Agricultural Research Station, Condobolin. Some 200 man-hours were saved in 1969–70 by using it. The machine cuts in half the overall harvesting-time and also cuts the travelling time where trials are away from the Station.

Fodder

Conditions were adverse for grain production, but favoured hay and silage production.

Grains.—There was a virtual failure of 1,000 acres of crop at Trangie, due to frost damage and to excessively wet conditions. At Tamworth, Temora and Condobolin winter cereal yields were cut 40 per cent by frost. Total grain production of winter cereals, all Research Stations, was only 8,500 bushels—from a sowing of 2,500 acres; as against 45,000 bushels from 2,400 acres in 1968–69.

Hay.—Production increased, from 1,400 tons in 1968–69, to 1,850 tons comprising—lucerne hay 930, cereal hay 620, pasture hay 300 tons.

Silage.—Temora and Glen Innes produced a total of 560 tons.

Fodder Transfers and Reserves.—Some 22,000 bushels of grain and 135 tons of hay were transferred within the Department for feeding livestock. Current fodder reserves at Research Stations are 42,000 bushels of grain, 1,800 tons of hay and 650 tons of silage.

1970 *Winter Cereal Sowings.*—The sowings this year totalled 2,700 acres; 200 more than in the previous year.

LIVESTOCK

Pastoral conditions excelled for most of the year and the normal stock-numbers at Trangie and Condobolin were inadequate for effective pasture-management—but a special allocation from the Treasury enabled purchase of extra stock, for proper grazing-management.

Conditions started to deteriorate in March, 1970 and by the end of June there was widespread call on fodder reserves.

Stock numbers at Research Stations (excluding Agricultural Colleges) at 30th June, 1970 were: cattle (beef and dairy; all types), 2,676; sheep (all types; excluding lambs), 23,022; pigs (all types), 521; poultry (pullets, hens and cockerels), 6,436; and 50 horses.

Agricultural Engineer Section

RESEARCH AND INVESTIGATIONS

Although research has been limited, pending completion of the Agricultural Engineering Centre and acquisition of supporting staff, considerable investigations have been done. *Inter alia*, the Regional Agricultural Machinery Officers undertook investigations indicated by types of enquiry received or by their observations of poor mechanization-methods.

Progress towards particular targets is reported:

Controlled Atmosphere (C.A.) Storage of Fruit

There has been notable interest and success in respect of the open-flame atmosphere-generator and plastic-tent system of C.A. storage of fruit; developed by the Argicultural Engineering section. Extensive tests had been conducted in the previous year on a prototype room, 1,500 bushel capacity, at Orange, and a 3,000 bushel tent at Batlow. This year, plastic tents mostly of 5,000 bushel capacity have been installed by many growers in the Orange and Batlow districts and the system is now generally accepted in these districts.

The system has enabled small orchardists to convert their existing cool stores to C.A. storage, on a bushel-cost basis comparable with the facilities of the larger growers and the co-operatives equipped with cold stores and C. A. systems. Moreover, information on the system has been sent by request to growers in Victoria and the Victorian and South Australian Departments of Agriculture.

A visiting Japanese engineer inspected the system and is now negotiating with a firm in Australia for purchase of a plastic tent and Departmentally designed generator. Enquiries have also been received from South Korea and Canada.

Rice Harvesting Improvements

Because of heavy field-losses in rice harvesting in the previous year, 40 acres was planted in the Coleambally Irrigation Area and nine common rice-headers were performance-tested. The South Western Regional Agricultural Machinery Officer (A.M.O.) organized an appraisal committee in association with the Irrigation Research and Extension Committee (I.R.E.C.). Each header was tested for cutter-bar losses, end-of-knife protection systems, cleaning-ability, speed of operation, and the mill-out of sample.

Information on the performance of each machine was tabulated and supplied to the manufacturer. The Regional A.M.O. was subsequently invited by David Shearer Ltd, Massey Ferguson Aust. Pty Ltd, International Harvester Aust. Pty Ltd, New Holland Aust. Pty Ltd, and Theiss Equipment Pty Ltd, to give advice to research and development engineers.

The extension work and research over the last two or three years by the Regional A.M.O. is notably reducing rice losses at harvest. The rice industry has been impressed and, through the I.R.E.C., provided the Department with a high-speed photographic-analysis camera ($5,700) to help analyse problems in rice headers and other machines.

Stored-Grain Aeration Studies

Control of insects in untreated wheat in aerated and unaerated silos were studied.

The aeration fans were operated automatically by thermostatic controls recommended in research literature. Intake of damp air during winter resulted in a big increase of grain-moisture content in the aerated silos and the swollen grain bulged the aerated-silo walls. Use of only temperature controls was therefore considered inadequate, so incorporation of humidistats was publicized for farmers' information.

Little difference between the aerated and the unaerated silos was observed in respect of insect populations.

A new trial was begun in December, 1969; collaboratively with a chemist and an entomologist from the Biological and Chemical Research Institute. The trial is to study the effect of aeration on duration of malathion effectiveness. Comparison of manually-set controls with an automatic control unit developed by the CSIRO is included.

Cultivation and Sowing Equipments for Various Soils

Five primary-cultivation implements common in the North Coast Region for maize seed-bed preparation have been assessed by the Regional A.M.O. in terms of speed and costs of the operation. So far, the work indicates that the mouldboard plough is superior to other implements. The project is continuing.

Mechanization in Vegetable Production

In the South Western Region the mechanization of vegetable industries in the Murrumbidgee and the Coleambally Irrigation Areas has been investigated. A comprehensive report on mechanization relative to rockmelons, carrots, potatoes and onions has been prepared; a report also on implements used there in the vegetable industry. These reports will be basic to future work in vegetable-industry mechanization.

The A.M.O. at Yanco Agricultural College and Research Station has built and experimented with a modified carrot-topper for cleaning onion hills, to encourage the onion-curing in the hill before mechanical harvesting. The unit, so far reasonably successful, warrants further work.

Damage to potatoes and carrots, at harvest and during washing and grading, has been subject of evaluation studies. "Permissible" heights of drop for certain potato and onion varieties have been preliminarily investigated.

A trial to demonstrate the advantage of potato seed-grading has been planted.

Electric, and New Types of Conventional Fencing

Experimental electric fences were installed at Grafton, Wollongbar, Condobolin and Temora Agricultural Research Stations—towards improving the technology of electric fencing. Existing, commercial electric-fencing equipments are being field-assessed to identify operational problems and assess the type of fence.

Tyne-Point Wear-Rates

Cast chisel-points and scarifier shares made from special alloys have been distributed for field-testing supervised by the Southern and North-Western Regional A.M.O.'s. The objective is to devise tyne-points to wear longer under abrasive tillage-conditions. Conclusions are not yet possible.

Hard facing-metals have been welded to scarifier shares and tested in Southern Region. The tests have revealed improved tyne-life, but the economic benefit does not yet appear to be great.

Tractor Operation and Repairs Survey

Tractor log-books have been located with about 100 farmers throughout the State by the Regional A.M.O.'s. Data for future analysis are being collected from these farmers; to determine operational costs and problems.

Some of the Research Projects Pending

Because of non-completion of the Agricultural Engineering Centre at Glenfield, a number of programmed projects were not started. These concerned: materials used in orchard sprayers; power needs for tillage; haymaking systems; fodder conservation; citrus waxing plant; banana washing and waxing plant; and grain conveyor capacities.

Tobacco Industry Equipment

The Assistant Agricultural Engineer visited Queensland and Victoria to examine and assess equipment being used to grow, harvest and cure tobacco. The objective is to improve mechanization in this industry in N.S.W. Funds were provided from the Tobacco Industry Trust Account, and a report will be made to the Trust.

Electro-farming Matters

The Chairman of the Electricity Authority of N.S.W. and the Director-General of Agriculture have agreed that a joint committee be formed—to meet regularly to discuss problems in Electro-farming.

Surveys in Hand

The Regional Agricultural Machinery Officers are currently conducting surveys on: Tractor operating/maintenance problems; Relationship between wheat acreages and items of wheat-production machinery in Western Region; Potential demand for a lucerne dehydrator in the Western Region; Mechanical harvesting of fruit in the M.I.A.; Potato and carrot harvesting systems, to determine machines' capacities and efficiencies; Damage to potatoes and carrots at harvest; Vegetable-planters available; Grain-storage facilities in the Southern Region; and Hay-making methods.

Engineering Assistance to Departmental Research

Besides general, continuing assistance—of engineering nature—to various research workers, the Agricultural Engineer Section provided the following specifics:

(i) Design of an improved forward-drive system for a plot forage-harvester for the Agricultural Research Station, Glen Innes.

(ii) Development of an expandable packing-case for banana-packing trials at the Tropical Fruit Research Station, Alstonville.

(iii) Design of an automatic watering-system for pots in a banana-nutrition trial at that Station.

(iv) Assessment of modifications needed to improve the safety of fumigation chambers for the Export and Import Branch, Division of Horticulture.

Extension Work by the Division of Research Stations

VISITORS

The high level of public interest in the Research Stations and their operations continued to expand. Visitors to International Congresses held in Australia, interstate and overseas research workers and administrators, as well as local people and visiting notables were received at Research Stations.

BY THE RESEARCH STATIONS

Stations' Field Days.—Fourteen of the Research Stations conducted field days (20), attended by 1,800. A Summer Crops Field Day at Leeton Station drew 73 visitors; at Glen Innes 50 attended a Row Crops Field Day; at Yanco 300 attended the annual Rice Field Day; 200 attended the Dareton Station's annual Field Day (sponsored by the Sunraysia Citrus Co-operative Ltd); at Tamworth an Open Day drew 150 visitors with interest in the latest from research in the bread and durum wheat breeding programmes, weed control, cereal grazing, linseed and safflower growing, and sheep production studies. Pastures work was highlighted at the Condobolin Station's field day, attended *inter alia* by members of the Wheat Industry Research Committee which has supported research at the Station to the extent of $48,000 in 1969–70.

Radio, Television and Publications.—Radio and television were effectively used by the Station Managers and staff. For example: the Poultry Research Station, Seven Hills originated six tape recordings on research findings for distribution by the Australian Broadcasting Commission through regional broadcasts; the Agricultural Research Station, Narrabri, produced six Research Newsletters—on cotton, soybeans, and irrigated oil crops, etc.—for distribution to irrigation farmers and Departmental field officers (local organizations distributed 300 copies of each).

EXTENSION BY THE AGRICULTURAL MACHINERY OFFICERS

Effect of Extension Programme Planning

The Regional Agricultural Machinery Officers did situation analyses for the respective Region and, from these, they programmed objectives and work-plans. Difficulties were experienced in implementing these plans, due to seasonal conditions and too-optimistic estimation of the amount of work possible. Even so the work done in this connection was worthwhile and the programming did orientate the activities to the actual needs of the farmers.

A summary of the progress towards the extension targets is set out, per Regional Agricultural Machinery Officer:

North Western Region

Farm Grain-storage Facilities.—The setting of wheat-delivery quotas, with consequential need for additional farm-storage facilities, and the great increase in dryland and irrigated coarse-grain production caused heavy demand for guidance in the construction of farm-storage. The Regional A.M.O. played a major role in designing grain dryers made by local manufacturers. The dryers are finding ready acceptance, in this Region and beyond, and proving much more satisfactory than their predecessors for the quick drying of coarse grains. The A.M.O. has been accepted as an authority on grain-storage facilities, screening and drying in the Region. His advice is sought by the farmers and the manufacturers.

Matching of Tillage- and Sowing-Implements with Tractor H.P.—Little, based on scientific data, could be done to increase farmer knowledge about this. The equipment for this project could not be made, because the Agricultural Engineering Centre, Glenfield, was not yet established. However, advice based on field-experience was given to individual landholders.

Fences in the Black-Soil Districts.—A field day was held to demonstrate the unsatisfactory results of trial fences established on properties. Many people in the district had thought these fences could be satisfactory. Soil movement caused by wet and dry conditions has so far made abortive the search for a suitable fence.

Farm Welding.—Two successful welding schools were held in the Region.

North Coast Region

Pasture- and Crop-machinery.—Considerable interest has been engendered amongst dairy and beef farmers, particularly in Kyogle Shire, concerning more extensive use of machinery to improve cultivation and sowing methods for pasture and fodder production. A field day, attended by 2,000 was held. This demonstrated cultivation implements and pasture-establishment and management machinery. Another field day, attended by 200, demonstrated row-crop machinery.

A 15-acres demonstration block was sown with maize; using the five different implements used in the district. Costs for each method of establishment have been derived, for use in extension work.

Electric Fences.—Following the erection of demonstration electric fences at Grafton Agricultural Research Station and other relevant extension work, several farmers have erected electric fences as trials. These are being evaluated by their neighbours, and there is evidence that many more farmers are either planning or contemplating to erect them. Moreover, many landholders outside the Region have asked for information about these low-cost fences.

Farm Welding.—There has been unpredicted demand for welding schools in this Region. Six such schools were held in districts of the Region this year.

Western Region

The Low-cost C.A. Storage System.—Considerable progress was made in helping growers to make, operate and maintain the new system developed by the Department. The Regional A.M.O., guided by the Assistant Agricultural Engineer, assisted 11 fruit growers who aggregated 40,000-bushel "tent" capacity and one grower who installed a 10,000-bushel sealed cool-room. Because the new system offers such promise, nation-wide, a lot of time was devoted to ensure that each unit worked well.

A *demonstration tent* was set up at the Australian National Field Days, Orange, and drew interest from orchardists from several States.

The Fencing Project.—A most successful aspect of this was the demonstration, instigated by the Regional A.M.O., at the Australian National Field Days, Orange. All the latest types of fencing and fencing-equipment available in Australia and New Zealand were on display. Thousands of people examined the various fences erected, and saw the daily demonstrations of the latest fence-erection methods. A booklet on fencing, for the Western Division, has been drafted for release in the ensuing year.

The Australian National Field Days Work.—The Regional A.M.O.'s work for the success of the four-days event was worthwhile. Over 23,000 visitors paid for admission; 200 firms participated, and comparative-demonstrations of machinery and equipment were held from 9 a.m. to 5 p.m. each day for 4 days. One of the days was specific to orchard equipment. Over 200 newly-released machines were demonstrated.

Some 4,500 "Catalogue-Programmes" of the Field Days were sold. The Catalogue-Programme (216 pages), containing information about 1,000 items of machinery, was prepared by the Regional A.M.O. The event not only keeps far-flung landholders in touch with developments; it has a stimulating effect on manufacturers.

Southern Region

Hay-making Machinery.—As a result of the extension work to improve the efficiency of haymaking by the economic utilization of machinery the Wagga, Cootamundra and Temora machinery dealers have stated that farmers are now more selective when purchasing and are maintaining their machinery in a better condition instead of replacing it.

Local manufacturers have been assisted to improve the design, and the manufacturing methods, of a turbo-mower and twin-knife mower that will speed up hay-making operations

Improved Serviceability of Tractors and Hay-making Machines.—An off-season service campaign amongst farmers was conducted. This was in association with eight dealers in the Region.

The New C.A. Storage Equipment.—In association with the Assistant Agricultural Engineer, the Regional A.M.O. helped the progress of acceptance of the Department's low-cost system of controlled atmosphere storage in this Region.

One co-operating farmer, who in the previous year installed one room, this year increased his C.A. storage to five rooms aggregating 19,000-bushels capacity—including 12,000-bushel plastic-tent storage. Another grower has just installed a 10,000-bushel room.

Low-cost Fencing.—Achievements from the extension work are indicated by the fact that, whilst total sales of fencing materials are reported by dealers to have remained about normal, the sales of high-tensile wire and pressure-treated posts have been significantly higher in various parts of the Region.

Farm Welding.—Two successful welding schools were held.

South Western Region

Efficiency of Rice Harvesting.—Following the Rice Header Comparative Demonstration in April (nine machines were tested before an audience of 500 rice growers) the Regional A.M.O. visited Victoria and South Australia by invitation of machinery firms to discuss with their engineers the problems in rice-header operations. As a result, the range of modifications made by these firms will mean more efficient rice-harvesting.

Because of the extension work of the A.M.O., rice growers have become more critical of the standard of work done by contractors and are paying more heed to maintenance and adjustment of their own machines—with resultant reduction of harvest losses.

Farm Storage of Wheat.—The wheat-delivery quota system made extension work on farm-storage very important in this Region. As a result of an intensive campaign through farmer-schools, radio, television, leaflet-distribution, and the good co-operation by manufacturers and sellers of storage equipment, few farmers in the Region had difficulty in storing their over-quota wheat.

In addition to the detailed Programme Planning aspect, the following is an outline of the general extension activities of the agricultural machinery section.

Extension Activities General to the Agricultural Machinery Officers

Field Days.—Besides the Australian National Farm Machinery Field Days (4 days) at Orange, 27 Machinery field days were held, on: rice machinery; citrus sprayers; sunflower harvesting; parallel-flow drying-equipment for prunes; potato harvesting; onion harvesting; permanemt electric-fences; latest fencing-methods; fences for black soil country; stump-removing equipment; fertilizer equipment; cultivation improvement and pasture management machinery; row-crop machinery; farm-safety demonstrations; jetting machinery; farm road-making machinery, and forage harvester machinery.

Three attempts at a machinery field day to demonstrate equipment to control plague locusts had to be abandoned due to unfavourable weather.

Talks.—Seventy-seven lectures/talks were given at meetings of farmers, conferences, schools and symposiums, on: fodder conservation; rice machinery; farm storage, aeration, drying, screening and handling of grain; selection and maintenance of farm machinery; tractors and farm vehicles; maize machinery; farm workshops; setting of ploughs; adjustments to headers; identification of metals; principles of welding; mechanical handling of fruit; controlled-atmosphere storage of fruit; use of electricity in farming.

Farmer Tours.—Two interstate tours for farmers were arranged by Agricultural Machinery Officers. The respective A.M.O. accompanied and advised the farmers on improved mechanization methods. The North Western Region's A.M.O. travelled with a group of wheat farmers to see developments on the Darling Downs, Queensland. The Southern Region's A.M.O. accompanied a party to Shepparton in Victoria to see developments in orchard machinery.

The Agricultural Engineer organized a tour of the Murrumbidgee Irrigation Areas, for 40 professional engineers; to study the trends in agricultural engineering there.

Agricultural Machinery Officers conducted nine other tours in N.S.W. with groups of farmers, to inspect grain-storage installations and the operation of various items of new farm machinery.

Publications.—Besides publications listed in *Appendix II* of this Report of the Department, roneoed notes were prepared by the Agricultural Engineering and Machinery Officer personnel—on 25 subjects for extension purposes. This material, after further editing, will be prepared as formal extension pamphlets.

Public Watering Places in the Western Division

Responsibility for maintenance of these Public Watering Places, an integral contribution to the far western transport or travel-network of livestock, is vested in the Division of Research Stations.

Contrary to general opinion an appreciable amount of the stock-movement in the Western Division in still "on the hoof". A survey in the Western Division Zore 3 years ago embraced a 5-years period and revealed that 40 per cent of stock-movements were still "on the hoof". Thus, the Public Watering Places have to be at a standard to meet the considerable needs of travelling stock.

Maintenance and improvement of the Public Watering Places in Western Division continued this year at a similar rate to that of the past 2 years—with expenditure approximating $90,000. Maintenance expenditure for the last 5 years now aggregates $570,000.

New Works Undertaken.—This year there were the erection of stock-trucking yards at Tibooburra and Wilcannia ($2,400 each), excavation of a 14,000-cubic yard tank at Byjerkerro Station, Wilcannia ($4,156), and a 10,000-cubic yard tank on the Walgett-Cumborah-Goodooga Travelling Stock Route ($5,315); construction of 3 x 20,000-gal reinforced-concrete storage tanks at new bores at Allambie, Capaulin, and Yantabangee, Wilcannia District ($2,820). A store-workshop was completed at the Supervisor's Depot, Cobar ($2,500).

The Maintenance Work.—This included the desilting of Mt Wood Tank ($4,930), re-lining of Birrigoolpa Bore ($3,300), and reconditioning of the bywash at Double Tank ($5,890).

The Work Force.—As mentioned earlier in this Report of the Division, the former work force of ten labourers has been re-organized as to categories and number.

Administration of Drought Relief

This, too, is a responsibility of the Division of Research Stations. The drought position had begun to ease towards the end of the 1968–69 period of report and continued to improve during 1969–70. But towards the end of this 1969–70 period the position deteriorated. At the start of July, 1970, some 14 Pastures Protection Board Districts or portions of Districts had been declared as Drought Areas.

Liaison Activities of the Division of Research Stations

The Division of Research Stations, by reason of the broad range of its activities, is heavily committed to a broad area of miscellaneous liaison activities.

FORMAL COMMITTEES

Officers of the Division were members of a number of formal Committees, including: the Standing Committee on Drought Relief, the Standing Committee on Unemployment Drought Relief, the Agricultural Machinery Sub-Committee of Review (Wheat Industry Research Council), a Sub-Committee of the Board of Secondary School Studies (Agricultural Engineering Course—Higher School Certificate), the Board of Studies (Curriculum of Hawkesbury and Wagga Agricultural Colleges), the Executive Advisory Committee for Safety in Rural Industries, the Bush Fire Committee of N.S.W., the Intra-Departmental Committee on Occupational Safety and Occupational Health, and the organizing Committee of the National Farm Machinery Field Days.

AGRICULTURAL ENGINEERS' LIAISON WORK

The Agricultural Engineers attended meetings of the Agricultural Engineer's Branch of the Institution of Engineers (Australia), the Agricultural Engineering Society of N.S.W., the Australian Lead and Galvanised Iron Development Association, the Local Government Iron Development Association and Local Government Field Days. They also attended the Department of Labour and Industry Schools, on Training in Industry, the National Workshop on Pasture Establishment Machinery, the Australian Vegetable Research Conference; and schools on occupational safety, and fire control and prevention.

They sustained continuing liaison with industry, the staff of external research organizations, the CSIRO, the Universities, and the Standards Association of Australia.

Distribution of the Agricultural Engineer's Overseas Report

Copies of the report were supplied to the State Department of Agriculture in Victoria, Tasmania, South Australia, and Western Australia, and the Department of Primary Industries, Queensland, the University of New South Wales, the University of Sydney Faculty of Engineering and Faculty of Agriculture, and elsewhere.

DIVISION OF PLANT INDUSTRY

General

PROFESSIONAL STAFF

Senior Staff Changes

Mr A. C. Orman, Chief of the Division since August, 1968, retired on 8th March, 1970 and was succeeded by former Deputy Chief, Mr L. R. Kavanagh. Former Principal Agronomist (Extension) Mr E. W. Bowmaker is now Deputy Chief and Mr R. T. Spencer has relinquished the position of Principal Agronomist (Vegetables) to be Principal Agronomist (Extension). Mr Spencer's former position was not filled at 30th June, 1970.

Mr J. E. Jessup, formerly on secondment to Central Administration as Executive Assistant has accepted appointment there as Executive Officer (Agricultural Education) and has thus transferred from the Division of Plant Industry. Former Assistant Principal Agronomist (Research) Mr R. J. Jessup is now on secondment to Central Administration in the position of Executive Assistant previously occupied by Mr J. E. Jessup. Mr R. J. Jessup's position in Division of Plant Industry remained unfilled at 30th June, 1970.

Former Principal Agronomist (Miscellaneous Crops) Mr G. A. Crawford is now Deputy Chief, Division of Research Stations. His successor in Division of Plant Industry was not appointed by 30th June, 1970.

Another important appointment was that of Mr P. A. Witschi to the newly established position of Special Agronomist (Irrigation), located at Leeton—headquarters of South Western Region; the first appointment of a Division of Plant Industry *Specialist* officer in a Region.

Professional Staff Numbers

Division of Plant Industry began 1969–70 with 171 established positions; 159 occupied and 12 vacant. At the end of 1969–70 there were 176 positions; 169 occupied and 7 vacant. Of the 176 positions: 26 are at head office and 150 in rural areas. Of the 150 rural positions: 76 are in research 73 in extension and 1 in administration. Whilst 6 new positions were established, 1 was deleted; a net gain of 5.

The 7 vacancies comprised 2 head office positions (Principal Agronomist (Vegetables) and Principal Agronomist (Miscellaneous Crops)), 4 Research Agronomist positions and 1 District Agronomist position. Of the 4 research positions vacant, 2 are tobacco research positions that are to be deleted.

The net gain of 10, in occupied professional positions, resulted from recruitment of 19 new officers (12 university graduates and 7 college diplomates), 2 transfers from another section of the Department, 1 person returning from National Service and 1 returning from secondment; *less* 7 resignations (4 graduates and 3 diplomates), 1 retirement, 1 person entering National Service, 3 transferring and 1 seconded to elsewhere in the Department.

Effects of Industry Funds on Research Establishment

Industry research funds again provided a major contribution to the Division's research programme. Of the $340,000 made available almost all came from industry-organization funds established under Commonwealth legislation. The salaries of 14 Research Agronomists as well as capital and operating expenses for a number of projects came from this source.

This year 2 research agronomists completed 2-year training periods with the CSIRO, with Wool Research Trust Fund support, and 5 others are continuing such training.

Effects of C.E.S.G. Funds on the Research Establishment

Commonwealth Extension Services Grant funds also continued to support regional research and provided the salaries of 4 Research Agronomists.

District Agronomist Positions

At the start of 1969–70, 1 of the 46 District Agronomist positions was vacant. Seven more became vacant; 2 by resignation and 5 by transfer to other positions. Also, a new District was created at Coonamble. This effected another vacancy. 8 of the 9 District Agronomist vacancies were filled; 7 by officers drawn from the in-service training programmes and 1 by a former District Agronomist who had rejoined the Department. Thus, again at the year's end, only 1 District was vacant.

Post-Graduate Study and Training

At 30th June, 1970, 5 agronomists were engaged in Ph.D. studies at Australian and U.S.A. universities.

Four agronomists who completed periods of 1 to 2 years in co-operative research and training with the CSIRO in Canberra and Griffith took up positions within the Division. Unfortunately, 1 subsequently resigned. Six agronomists are now seconded to the CSIRO (Canberra, Armidale, and Griffith) working on pasture and irrigation research. One agronomist is still seconded to the University of New England for research into the control of bloat in cattle through pasture management, and 1 to Macquarie University to develop a mathematical model of the growth of wheat.

Twenty-six agronomists are now registered as masterate students at various universities in New South Wales. Master's degrees were awarded to 4 agronomists during the year. All officers training with other organizations have registered their projects as vehicles for higher degrees.

Two newly appointed agronomists have been located at the Tamworth Agricultural Research Station for 1 year for training in plant nutrition and plant physiology prior to taking up their permanent positions.

Officers in Extension Diploma Courses

Three District Agronomists were selected to attend in 1970 the inaugural post-diplomate/post-graduate Diploma of Rural Extension course at Hawkesbury Agricultural College.

Two District Agronomists returned to duty early in 1970 after completing a Post-Graduate Diploma course in Extension, respectively at University of Melbourne and University of Brisbane.

External Degree Courses

Five District Agronomists are undertaking external degree courses, 3 at the University of New England and 2 at Macquarie University.

Agronomists-in-Training for Extension

Special attention was paid to in-service training of officers for District Agronomist positions. At present 23 officers are in this stage of development. Three of them are at an advanced point, in Regions, as the final step before appointment to a District, and 2 are now in National Service.

Overseas Study Tour by Maize Specialist

Mr J. W. Boyle, Principal Agronomist (Maize), made a study tour of U.S.A., England, and Northern Italy, from August to October, 1969. In U.S.A. Mr Boyle visited the principal maize and grain sorghum growing States to observe breeding methods, seed production and certification techniques, commercial crop production and marketing and utilization of grain. At Wisconsin, U.S.A., and in England he observed cold-tolerant maize hybrids capable of germinating at lower than normal temperatures. In Italy he compared the performance of U.S. hybrids with their performance in Australia. A detailed report is in course of preparation. Funds for the study tour came from the Commonwealth Extension Services Grant.

PROGRAMME PLANNING

For Research.—Programme plans for the year 1970–71 have been developed in respect of each Research Agronomist and a review made of the extent to which plans for 1969–70 were achieved. While it has been difficult to assess the impact of programme planning on research, it is evident that the objectives of the operation have been achieved in part only.

For Extension.—The "extension programme planning" policy launched in 1968 was actively pursued by most Agronomists; exceptions were those recently appointed to new Districts. The planned programmes have proved useful in organizing the activities but also in assessing extension effectiveness.

With each review and revision of District Agronomists' annual programmes, objectives have been reshaped. More weight is being placed on group extension, and on economic and whole-farm goals. Another effect is the increasing role of close co-operation with other extension officers—the District Livestock Officers and Dairy Officers, and Regional Economics Research Officers.

Following the introduction of wheat delivery-quotas, much of the planning has been concerned with alternatives to wheat. Because of limited outlets for most other crops except at low profit margins the problem is difficult but has not been avoided by the District Agronomists. Generally, the alternatives comprised improvement of pastures to foster livestock production, promotion of oil seed or coarse grain crops, and, withal, attention to methods to minimize production costs.

Another programmed activity involved work with Farm Records Analysis Groups (see "Division of Marketing and Agricultural Economics" section of this Report). Seven District Agronomists had approval to establish such Groups.

SOME ACTIVITY STATISTICS OF DISTRICT AGRONOMISTS

On average, the District Agronomists each worked 225 days: 91 days in the office, 18½ days in attendance at conferences and schools, and 115½ on field work. The field work included advising on pastures and crops, conduct of experiments, servicing field days, land settlement and farm water supply inspections, seed production schemes, farm competitions, and miscellaneous matters. On average, the District Agronomists each conducted 6 field days aggregating an attendance of 283 and 6 meetings aggregating an attendance of 200, made 27 radio broadcasts and 1 television appearance, and issued 19 publicity statements. The aggregate activities in these fields comprised:

Field Days and Schools for farmers	229 (attendance 9,842)
Meetings	217 (attendance 7,045)
Radio broadcasts	973
TV appearances	33
Press releases	671

The figures for field days, radio broadcasts and press releases are less than in the previous year and *inter alia* would reflect the reappraisal of objectives in light of wheat delivery quotas.

PLANT EXCHANGE

Seed introductions from overseas sources totalled 189 and 164 samples were sent to overseas research workers.

Cereals Work

WHEAT

Acreage and Grain Production

Preliminary figures indicate that wheat sowings for all purposes totalled 8,700,000 acres and that the 8,500,000 acres sown for grain produced 167,000,000 bushels at a yield average of 19·6 bushels/acre. The significant drop in acreage from that of the previous year was due mainly to the declaration of delivery quotas and, in some areas, to prolonged waterlogging during the intended sowing period.

Deliveries to the Australian Wheat Board (as at 1st June, 1970) totalled 153,200,000 bushels. The remainder was held back on farms for use as seed or feed. Of the delivered total, 86,100,000 bushels was classed as F.A.Q. About 7,500,000 bushels commanded a premium and 59,600,000 bushels received a dockage.

At the start of the 1970–71 sowing season another significant acreage decline seemed certain; reflecting announced reduction in delivery quotas.

Premium Wheats

Local premium wheat payments by millers (to 29th May, 1970) totalled $135,062; paid on 2,028,320 bushels. These, on Australian Wheat Board figures, included 1,232,033 bushels of soft varieties and 599,418 bushels of hard bread-wheat varieties; the lowest hard-varieties total for many years. In the previous season the premiums totalled $153,857, on 1,726,502 bushels of soft and hard wheats.

This year a record quantity of 196,869 bushels of the durum wheat variety Dural gained premiums.

The premium-average for hard bread-wheat varieties was 6·91 cents/bushel; for soft varieties, 4·08 cents; and for durum 21·96 cents.

Highest premium-average for individual varieties was paid for Dural (29·6 cents/bushel); for the hard bread-wheat varieties: Gala (11·99 cents), Gamut (10 cents), Mengavi (6·9 cents) and Timgalen (6·8 cents).

Using local-premium acceptance-quantities as the gauge, the most popular hard bread-wheat varieties were Timgalen (51·6 per cent), Mendos (25·5 per cent) and Gamut (17·1 per cent). Of the soft wheats the three varieties Pinnacle (69·4 per cent), Bencubbin (13·1 per cent), and Insignia (7·6 per cent) comprised 90 per cent of the deliveries commanding a local premium.

In addition, a further 5·6 million bushels of wheat tested for protein were received at selected receival points for eventual sale at a premium to local and/or overseas buyers (as against 29·4 million in the previous season).

Wheat Quality Standards

For the 1969–70 harvest five standards were declared by the New South Wales F.A.Q. Standards Committee; Prime Hard, Northern Hard, Southern-Western F.A.Q., Northern Weather-damaged, and N.S.W. Off Grade. The standard for Prime Hard (mainly from northern N.S.W.; exported from Newcastle) was 62¼ lb/bushel (14 per cent protein); for Northern Hard, 62½ lb (11·9 per cent protein); for Northern Weather-damaged, 59 lb (12·8 per cent protein); for Southern-Western F.A.Q. (related to wheat to be exported from Sydney) 63 lb (11·1 per cent protein); for N.S.W. Off Grade (mainly from the southwest) 60 lb (11·1 per cent protein).

Weighings for the declarations were made on the official Schopper scale. This normally records weights of up to 1½ lb higher than those on the Franklin chondrometer.

It is of interest, for comparisons, that 1968–69 Prime Hard was declared at 61 lb (protein 14·8 per cent, on a 13·5 per cent moisture basis); Northern F.A.Q. at 62¼ lb (protein 12·8 per cent); and Southern-Western F.A.Q. at 63½ lb (protein 11·8 per cent).

The Prime Hard grain samples from the 1969–70 harvest were slightly less bright than in previous years, but uniformly hard in appearance. The Northern F.A.Q. grain sample was predominantly hard but more mixed in colour than usual. The Southern-Western F.A.Q. was of reasonably bright and even colour. The Northern Weather-damaged sample contained a lot of sprouted grain, of both soft and hard appearance. The N.S.W. Off Grade wheat was brighter than the Northern Weather-damaged sample and, visibly, less affected by weather. A notable feature was the cleanliness of grain in all samples.

Popularities of Wheat Varieties

Variety statistics for the 1968–69 season show that Heron remained the leading variety in the State. Gamut, named as recently as 1965, rose from sixth to second position. Its maintenance of resistance to rust and its good grain-quality have been important in its acceptance by farmers. Falcon dropped slightly in popularity. Olympic and Mendos maintained their area percentages. Gamenya and Festiguay decreased in popularity, mainly due to increasing rust infections in northern areas.

Wheat Variety Recommendations

Heron was deleted from recommendations, in favour of Robin. Robin is a very similar variety, except for slightly earlier maturity and a slightly higher yield.

Because of increased emphasis on hard wheat, Falcon is now recommended for higher fertility soils or after improved pastures in all central and southern dryland areas; the "inner zone", for which only soft varieties were previously recommended, has been abolished.

A policy change was made this year; in relation to registration, release and recommendation of new Departmental varieties released in New South Wales. In future, final responsibility for decisions on applications for registration and naming of new varieties will be vested in the Standing Advisory Committee on Wheat in lieu of the State Wheat Improvement Committee; the former also considers variety recommendations.

Durum Wheats

Until the 1970 sowing season all durum grown commercially in N.S.W. was of the Department-bred Dural; grown in the north. More than 200,000 bushels was harvested from about 10,000 acres sown in 1969; compared with 180,000 bushels in the previous year. All, except what was held for seed, sold at premiums (see "Premium Wheats").

New dwarf durum crossbreds evolved in the Department's northern wheat breeding programme, centred at Tamworth, were again tested in 1969. Of these, Duramba (formerly No. 2030) has given good results in field and quality tests and is being seed-increased to replace Dural. Duramba has the advantage of short, stiff straw; inherited from one of its parents, a Mexican variety.

A Tamworth milling firm arranged Duramba contracts with growers for 1970 sowings, to ensure regular supplies for the expanding markets foreseen here and overseas by the Wheat Board for this type of wheat.

Wheat Quality

The Chemistry Branch co-operated in the quality-assessment of new varieties under test at Research Stations and on co-operating farmers' properties. Some 800 samples were supplied for testing. Uniform quality testing of a number of promising crossbreds was done also by collaborating laboratories.

Following tests, the crossbred AR Falcon 28A from Wagga Agricultural Research Institute was accepted for registration as "Eagle". Depending on final yield and quality tests, one or more other lines may also be considered for release.

The Principal Agronomist (Cereals) judged the bench characteristics of wheat in the open classes at the 1970 Sydney Royal Show. 82 samples were entered, as against 70 in the previous year. The best samples in the main classes were of good standard but, in general, quality on the bench was mediocre. Many samples were weather damaged, and blackpoint was more prevalent than usual. Highest scoring entry was a sample of the Department-bred Robin. Of the 13 varieties amongst the samples entered, the order, in terms of number of entries per variety, was: Gamut (17), Timgalen and Olympic (11 each), Heron (10), Falcon (8), Festiguay and Robin (7 each), Gamenya and Spica (3 each), Mendos (2), Pinnacle, Insignia and Summit (one each).

Cereal Breeding and Research

Most of the cereal plant breeding and research is carried out at the Wagga Agricultural Research Institute and at Tamworth Agricultural Research Station, under the control of the respective Director. (See the "Decentralized Agricultural Research Directorates" section of this Report.) Division of Plant Industry maintained close liaison with them.

Wheat Experiments—Variety Trials

Randomized and replicated wheat variety trials were arranged with 106 farmers (98 in 1968–69) working under the supervision of 30 (29) District Agronomists and testing a total of 23 (22) varieties. Also, wheat variety trials were conducted at seven Research Stations. These tested, by comparisons with standard varieties, many promising crossbreds and new varieties.

Despite post-sowing waterlogging in some areas, and extensive September frost damage, a high proportion of trials were harvested (130 trials harvested, as against 124 in 1968–69).

Performance of New Wheat Varieties

In the north the new varieties under test included Gatcher (TR236) developed by the University of Sydney, Eagle (A.R. Falcon 28A), and the Tamworth Agricultural Research Station line, 8127–266. These three rust-resistant varieties showed up fairly well in comparison with rust susceptible varieties, as stem rust caused significant losses to Falcon, Gamenya and Mendos. The results of some trials were treated with caution as head-frost damage in mid September caught some varieties at a more susceptible stage of growth than others.

In central and southern N.S.W. the new varieties tested included Summit (Victorian origin), and 3 developed by Wagga Agricultural Research Institute, viz., Eagle, M1238–2 and M1224–2. Because of stem rust prevalence Eagle did better than Falcon in many trials. Eagle's stem-rust resistance is of interest, since this is the first commercial-possibility wheat incorporating an Agropyron-gene for stem rust resistance.

M1238–2, a semi-dwarf early maturing variety with hard grain, was significantly damaged by stem rust in many trials and yielded very poorly overall. Moreover, it had previously been rejected by the Uniform Quality Testing Committee because the grain was assessed as too hard for commercial use. In contrast with the previous season, M1224–2, a mid-season variety with soft grain, did well in comparison with Olympic. Summit once more was superior to Pinnacle.

Irrigated-Wheat Research

The Research Agronomist (Irrigated Wheat) conducted trials in the Murrumbidgee Irrigation Areas.

Seeding Rates.—The 2 trials, at Leeton and Griffith, indicated maximum yields from a seeding rate of about 100 lb/acre.

Depth-of-Cultivation.—The trial showed no yield advantage for deep ploughing. This result was perhaps influenced by the above average seasonal rainfall.

Irrigation Frequency and Duration.—Optimum irrigation-frequency and cut-off time were determined for the conditions prevailing at Yanco in 1969. But more detailed studies over a number of years are needed before general recommendations may be made.

Gypsum.—Gypsum application on a particular soil type showed a slightly significant yield response in favour of it. This superiority would need to be maintained for 10 years to economically justify the use of gypsum.

Wheat Fertilizer Trials

Six wheat variety x fertilizer interaction trials were conducted in the northwest. Five varieties—Gamut, Mendos, Mexico 120, Mexico seln. WW15 and Timgalen were tested; as well as half sowing-rates of Gamut and Timgalen. The results confirmed that the present commercial varieties respond similarly to applications of superphosphate, although in a few cases Mexico 120 showed more response than the other varieties.

Results of 5 seeding-rate trials did not support the use of seeding rates lower than 30 lb per acre in the northwest.

Trials conducted over a 3-year period indicated that urea side dressings increased grain protein but the resultant extra premium was insufficient to cover the extra cost.

The central west wheat fertilizer trials were continued but, after a very good start, severe frost damage in September complicated the yield results. In many trials the highest yields were from the nil phosphorus treatments, because these plots headed later than plots with applied phosphorus and thus were at a less susceptible stage of growth.

In 1969, less of the central western trials than in the previous year investigated simple nitrogen x phosphorus responses. This permitted more emphasis on environmental studies; investigating the relationship between nitrogen and phosphorus responses and factors such as temperature, humidity, rainfall, soil moisture, etc.

Field Wheat Competitions

In the 7 Divisional Dryland Championships conducted by the Royal Agricultural Society of N.S.W. (R.A.S.) most of the local and all of the championship judging was done by Departmental officers. The crops judged totalled 806, in 93 local competitions; as against 873 crops in 88 local competitions in 1968, and 628 crops in 73 local competitions in 1967. Entries in some of the local competitions were pre-judged by farmer judges, to reduce to a maximum of 10 the crops judged by any Departmental officer.

The following statistics for the 1969 dryland competition are of interest:

Division	Local competitions	Local entries	Championship crop	
			Variety	Estimated yield (bus/acre)
Northern	14	117	Gamut	50
Northern Slopes	14	137	Festiguay	55
Western	16	163	Gamut	55
Central Slopes	16	110	Gamut	59
Central Tablelands	3	20	Olympic	50
Riverina	16	136	Olympic	51
Southern Slopes	14	123	Olympic	60
Totals	93	806		

Besides the Dryland competitions the R.A.S. conducted a series of Irrigated Field Wheat competitions. These were conducted by 6 societies, in 2 Divisions. The Department was not associated with the judging, except to advise the R.A.S. on judging procedures, scale of points, etc. Following are details of the winning crops:

Division	Entries	Variety	Locality	Estimated yield (bus/acre)
Northern	9	Gamut	Walgett	55
Southern Slopes	32	Pinnacle	Griffith	56

OATS

Acreage and Production

Despite extensive head frosting in mid-September, and stem rust and lodging in late spring, the 1969–70 oat crop was estimated to be the second best on record; inferior only to the 1966–67 record of 41,000,000 bushels. An estimated 36,000,000 bushels of grain was had, from a harvested area of about 1,400,000 acres, at a yield average of 25·5 bushels/acre. Hay production was estimated at 250,000 tons, from about 140,000 acres; at a yield average of 1·8 ton/acre. Total sowings for all purposes were estimated at 2,200,000 acres, including 660,000 acres used only for green forage.

In the previous season (1968–69), 27,315,000 bushels was harvested, from 1,184,600 acres, at a yield average of 23·1 bushels/acre.

Popularities of Oat Varieties

The only changes in order of variety popularity were Bundy's advance from eighth to seventh and Acacia's fall from seventh to eighth place. Slight increase in percentage of area was achieved by Cooba, Bundy, and Coolabah, whilst Avon, Algerian, Belar, Fulmark, Fulghum, and Acacia decreased slightly. Cooba now occupies slightly more than one-third of the total area.

Oat Variety Recommendations

No new variety was included in State recommendations in 1970, nor was any variety deleted. A few minor changes were made only within Agricultural Regions.

Oat Experiments—Variety Trials

Replicated oat variety trials were sown in 1969 on the properties of 67 farmers (56 in 1968–69) under the supervision of 32 (29) District Agronomists who tested a total of 20 (20) varieties. Also, oat variety trials were conducted at 8 Research Stations. Many promising crossbreds and new varieties were tested against standard varieties in these trials.

Oat Variety Performances

The Temora Research Station crossbred Avon x Osage (M1255) yielded well in 1968, and was submitted and accepted for registration as "Miljee". But in 1969, many registered seed crops of it exhibited high infections of smut in the spring. Tests by the Biology Branch showed that it was resistant to covered smut (*Ustilago hordei*) but very susceptible to loose smut (*Ustilago nuda*). The crossbred has been withdrawn from trials and from further seed-increase.

A Glen Innes crossbred (P4315) did very well during the season. The early, opening rains encouraged early growth and good fodder production. In the late spring, when conditions favoured stem rust development, P4315 was favoured by its moderate resistance to the disease. Its grain development was satisfactory compared with the very susceptible varieties. These often produced poorly filled, low bushel-weight grain. Good rains in late spring enabled P4315 to show excellent recovery.

The Northern Oat Improvement Work

Because of lack of an oat breeder at Glen Innes Agricultural Research Station during the 1969 season, only a small breeding programme was fulfilled. Some promising crossbreds were sown in a replicated trial and in observation plots. It was possible to reject a number of lines because of smut-susceptibility, poor straw-strength, etc.

An oat breeder was appointed in 1970, but after the sowing season. A full sowing programme is expected in 1971.

Seeding- and Fertilizer-Rates

A factorial trial to determine the effects of nitrogenous fertilizer on green forage production and grain recovery (using 2 rates of sowing, 4 rates of nitrogen, and 2 different times of application) was concluded at Glen Innes Agricultural Research Station. Over the years the trial showed variable results. The most consistent significant result was response to high sowing rates.

At Wollongbar Agricultural Research Station a factorial trial to determine the effect of times and rates of nitrogen on oat growth was concluded. Dry-matter production and nitrogen content of the foliage increased with increasing rates of applied nitrogen.

BARLEY

Acreage and Production

Final statistics for 1969–70 are not yet available but it is estimated that about 600,000 acres of barley was sown for grain and that grain-production was about 15,000,000 bushels at a yield average of 25 bushels/acre. Acreage and grain production was each a record.

In 1968–69, the last season for which statistics are available, 11,186,700 bushels (6,273,000 of 2-row and 4,913,000 of 6-row types) was harvested from 486,000 acres at a yield average of 23 bushels/acre. Barley sowings, for all purposes, totalled 548,300 acres.

Barley Experiments—Variety Trials

Replicated barley variety trials were arranged with 36 farmers (25 in 1968–69) supervised by 25 (19) District Agronomists testing a total of 11 (13) varieties. Also, trials at Trangie, Leeton, Cowra, Yanco and Condobolin Agricultural Research Stations each tested a number of additional varieties.

Barley Variety Performances

Barley yields were adversely affected by head frosting in mid September, net blotch and scald (the most severe infections for some years) and stem rust. As well as yield losses, some varieties suffered bushel-weight reductions.

Abyssinian and Beecher did not do as well as in most years. In some trials they were noted as highly susceptible to leaf diseases. Noyep, which heads very early, was usually severly affected by head frosting in September. New varieties tested included Bussell, Dampier, Weah and Clipper and the four were usually superior to the standard Prior.

Barley Variety Recommendations

The only change in barley variety recommendations was the substitution of Resibee for Research. They are very similar except that Resibee is slightly earlier in maturity.

CEREAL RYE

Acreage and Production

Latest available production statistics are for the 1968–69 season when, for all purposes, 21,500 acres of rye was sown. Grain production was 96,000 bushels, from a harvested area of 8,300 acres, at a yield average of about 11·6 bushels/acre. Grain production in the 1969–70 season is thought to have been well above that of the previous season.

Varieties

The Department maintained basic seed stocks of Weethalle and Strain 8 and distributed seed of each variety to co-operating farmers for seed-increase and general distribution to other growers.

Cereal Pure Seed Production

Recommended and promising varieties of wheat, oats and barley were pure seed-increased at eight Research Stations and distributed to Registered Seed Growers throughout the State.

In 1969–70, foundation seed sowings at Research Stations totalled 125 acres of wheat (135 acres in 1968–69), 73 (85) acres of oats and 37 (24) acres of barley. Also, and associated with those sowings, initial selection and preliminary seed-increase of wheat, oats and barley were conducted at Temora Research Station.

A total of 326 (328 in 1968–69) Registered Seed Growers participated in the Registered Cereal Seed Scheme in 1969–70 and dispersed large quantities of pure seed to other growers. Altogether 169 (167) Registered Seed Wheat Growers, working under the supervision of 31 (25) District Agronomists throughout the wheat belt, using foundation seed supplied by this Department, undertook seed-increase of 16 (17) varieties: 120 (130) Registered Seed Oat Growers in 30 (28) District Agronomists' areas carried out seed-increase of 13 (14) oat varieties; and 37 (31) Registered Seed Barley Growers undertook pure-seed production of 7 (8) barley varieties in 22 (16) District Agronomists' areas.

A significant development in the Department's Pure Cereal Seed programme was the introduction of a policy to treat, with a systemic fungicidal dust (vitavax), all seed wheat and barley to be sown on or distributed from the Department's Research Stations within the wheat belt. Departmental research had indicated the value of vitavax for control of loose smut.

MAIZE

Acreage and Production

Increased Acreage.—Production continued to rise. Acreage sown increased by 52 per cent, while production was estimated at 66 per cent higher than in the previous season. The following tabulation of acreages sown and production achieved in the years from 1964 to 1970 are interesting:

Harvest years	Area (in thousands of acres)			Production (in thousands of bushels)
	For grain	Other purposes	Total	
1964	42	11	53	1,878
1965	42	14	56	1,607
1966	49	12	61	2,471
1967	52	9	61	2,320
1968	49	10	59	2,314
1969	55	8	63	3,010
1970	....	....	99	5,000

* Estimates based on District Agronomists' reports.

The larger area sown for the 1970 harvest was due mainly to the 36,000 acres under irrigation (18,000 in 1968–69) and the 10,000 acres sown on the northern tablelands (6,000 in 1968–69).

Damage by Mice Plague.—Although growers in irrigated areas had benefited from the previous year's experience the prospects of record yield average were reduced by the mice plague in the 1970 autumn. Damage was heaviest in the south but significant also in the north. Some crops were quite ruined, and overall loss in the south was 30 to 50 per cent. The harvest, with early potential of 6¾ million, was reduced to at most 5 million bushels—though this was still an increase of 66 per cent over the previous year.

New Hybrids' Performances.—The hybrid XL45, released in the previous season by a private company, continued to yield highly. Its grain size was reduced in many cases by excessive plant-populations. Other new hybrids also released by private companies, viz. PQ300, PQ301 and XL361, also produced consistently high yields.

The open-front header, with minor modifications, was used with mixed success to harvest the short- statured XL45. Development of this method offers significant economy in production.

Late Plantings Detrimental.—A cool period in October, 1969 delayed maize sowings in inland areas but the main crop was unaffected. Areas sown in late December and in January, with hybrids other than very early types, were checked by early frosts before maturity. On the north coast, lack of early season rain resulted in many late-sown areas. Early frosts occurred but only a small percentage of crops was affected.

Maize Utilization and Marketing

Use of hammer-milled whole ears of maize was popular and economical as a high-energy roughage for winter feeding of dairy cows on the coast. In recent years most of the coastal maize production (it has ranged from 1½ million bushels in the 1967 harvest to over 3 million bushels in 1970) has been thus utilized.

The area of waxy maize sown for starch extraction was stabilized at over 7,000 acres, all grown under contract to a private firm.

The contract system in relation to grain produced for breakfast-food manufacture continued.

Nutritional Disorders of Maize

Zinc Deficiency.—Most inland areas of maize showed zinc deficiency symptoms, particularly in alkaline soil areas and in irrigation projects where land grading required heavy cut and fill.

Co-operative studies with the Chemistry Branch continued in the northwest, to determine the most effective rates and method of zinc application to the plant. These studies also involved determination of the zinc needs of individual inbreds used in maize breeding programmes and the resultant hybrids.

Molybdenum Deficiency.—A case of molybdenum-deficient seedlings was noted; associated with seed produced on soil of low molybdenum-status. Routine checking of seed from suspect areas has reduced the incidence of this.

Boron Deficiency.—A joint inspection with the Chemistry Branch, of sweet corn at Parkes, detected symptoms indicating boron deficiency.

In field maize trials at Forbes a correlation was obtained between the application of zinc and boron and the prevention of malformed ears.

Hybrid Maize Improvement Programmes

Commercial Programmes.—Commercial organizations have made available an excellent selection of hybrids, ranging from very early maturity to mid-season maturity.

Interest in new inbreds from overseas was high and many were grown in approved quarantine areas for inspection by the Department.

The Departmental Programme.—Programmes to develop inbreds and subsequent hybrids of early and late maturing maize were continued at the Glen Innes and Grafton Agricultural Research Stations.

Emphasis *at Glen Innes* was on the derivation of male sterile and fertility restoring lines of early maturing inbreds. Inbred K4, used in a number of hybrids (including NES1002 and NEH7) was converted to the male fertility restorer form. A male sterile form of Inbred I.15125, used as a seed parent of the sweet corn hybrid Iochief, was also developed.

Back-crossing in the male sterility and fertility restorer development programme continued with eight lines whilst the subsequent inbreeding phase continued with nine lines.

In the programme to develop maize hybrids with grain of high lysine content, normal and opaque grains from a further generation of back-crossing were selected for analysis for lysine content.

Development of an open-pollinated Australian synthetic variety, co-operatively with the Queensland Department of Primary Industries, entered its second year. Sib pollinations were made in 50 strains to maintain lines in the Australian Maize Variety Collection.

In the testing programme at Glen Innes the hybrid NEH1347 showed a combination of high yielding ability and resistance to lodging.

The 1969–70 season *at Grafton* was generally favourable for maize growing, after one drought season and four seasons of damaging floods.

The double cross hybrid, GH390 (YI x 61A–3) (68 x HC) was released for commercia production. A project was completed to develop new inbred forms to enable the hybrid GM211 to be produced without detasselling as follows (68MS x 13B. NR) (C.I.21MS x C.I.7R).

Development of a broad-based composite from Mexican lines and the local hybrid GH128 was advanced by crossing F_1 progenies with a balanced mixture of F_1 pollen parents.

Activity in inbred development, introduction and maintenance was sustained with 421 lines.

Observation of second generation progenies of crosses between brachytic-2 dwarf lines and Grafton lines indicates that modifying genes are present in local lines. These will permit breeding of the modified dwarf types needed by commerce.

In the co-operative programme between Grafton and Glen Innes Research Stations to develop early-maturing, leaf blight-resistant maize, F_2 progenies of crosses between resistant Grafton lines and selected early maturing lines were grown. Inoculation with the leaf blight pathogen succeeded, and resistant plants were selected to permit the next step of reciprocal recurrent selection.

Some progeny of crosses of blight-susceptible lines and monogenic resistant lines were also inoculated, and reaction by 2 sources of resistance was observed for the first time.

Maize Breeders' Conference

The Second Australian Maize Breeders' Conference was held in New South Wales from 4th to 8th May, 1970; attended by Queensland and New South Wales representatives. The Departmental breeding centres at Grafton and Glen Innes, the commercial breeding centres at Armidale and Tamworth, and production areas at these centres, were inspected.

Maize Trials and Experiments

Hybrid Maize Yield Trials.—Twenty-two trials were conducted in 1968–69 to determine the yielding ability of early, mid-season and late maturing maize hybrids in their appropriate areas.

The high-yielding ability of early maturing hybrids XL45, QP300 and QP301 noted in 1967–68 was confirmed, and NEH1347 showed consistent high yield and good standing ability. NEH1317, which previously yielded well, was found to be prone to lodging. At lower plant densities the hybrid DS805A gave excellent results in inland irrigated areas. The short-statured hybrid XL45 also became popular in areas where spray irrigation was used, as the work of shifting irrigation pipes was reduced.

In mid-season maturity coastal trials the hybrids GH128, GH390 and GH360 continued to perform consistently.

In late maturing trials, the standard New South Wales hybrids GH128 and GH134 and Queensland hybrids Q692 and QK37 yielded well.

Maize Population Trials.—In population x rates of nitrogen trials, on soils normally considered reasonably fertile, most of the currently used early-maturing hybrids responded to nitrogen applications between 60 and 120 lb/acre; provided populations were kept at levels of about 20,000 plants/acre. Hybrid XL45 did well with 24,000 to 27,000 plants/acre and many top yielding commercial crops had 24,000 plants/acre.

Hybrid Maize Seed Certification

The following table gives the information on certified hybrid maize seed sealed in 1969–70:

Hybrid type	Growers	Acres	Sealed 50 lb sacks
Early	4	29	1,529
Medium	6	19	959
Late	31	466	16,516
Totals 1969-70	43	614	19,004
Totals 1968-69	49	626	19,960

SWEET CORN

Acreage and Production

Sweet corn was grown for canning in the usual centres; Tumut/Gundagai, Cowra, Forbes, Bathurst and Richmond/Windsor. Acreage was greater than the usual 3,000 acres, although floods reduced early season crops in the Richmond/Windsor district.

Good yield averages were obtained in most areas; main areas yielding 3 to 5 tons/acre, and several crops up to 7 tons/acre.

Hybrids NK195 and NK199 became the dominant varieties at Cowra and Tumut/Gundagai but the previous standard, Iochief, remained popular at Richmond/Windsor.

Quick-frozen, husked and trimmed ears in clear polythene packs were marketed on an increasing scale.

Sweet Corn Improvement Programme

Three new lines of inbred I.453 and one of I.5125, the parents of Iochief, were grown at Glen Innes Agricultural Research Station in comparison with lines currently being used in the production of commercial hybrid seed. The new lines were identical with established lines.

Ten inbred introductions from Manitoba, Canada, were grown for seed-increase. But because of extreme earliness and stalk-lodging they were discarded.

The male sterile line of I.5125 was increased, and a restorer line of I.453 showed full pollen fertility.

Popcorn

Interest in popcorn was shown by major processing firms. The area at Mudgee increased fourfold to 260 acres, whilst the northern tablelands area remained static. Irrigated hybrid popcorn at Mudgee yielded 60 to 80 bushels/acre.

The programme to develop male sterile and fertility restorer forms of the parents of the hybrid NEP37 was continued.

GRAIN SORGHUM

Acreage and Production

Events in the wheat industry encouraged the record sowing of grain sorghum, estimated at 265,615 acres; 93 per cent more than in 1969. It comprised 75,620 acres under irrigation and 189,995 on dryland, mainly in the northwest but extending south to Cowra.

Most irrigated areas were sown in November; relatively late because of low temperatures and frosts in October. Most of the dryland sowing was delayed into late December and early January; exposing the crops to sorghum midge at flowering. With relatively mild summer weather, particularly in southern areas, crops matured slowly and some were harvested at relatively high moisture levels with subsequent drying in artificial dryers.

Mice, which caused more spectacular damage in maize, also caused heavy damage to grain sorghum—more apparent as harvest progressed.

The initial estimate of production, 10 million bushels, was reduced to 8 million bushels. This, even so, was a dramatic increase on the 3·8 million bushels harvested in 1969.

Commercial seed firms again produced a wide range of sorghum hybrids, including many first releases on commercial scale. Four seed firms operated, with agencies in N.S.W. and Queensland, and competition was keen. In all, 24 hybrids were offered for sale.

Small areas of waxy sorghum were grown under contract to a private firm. No waxy sorghum hybrid was available.

Development of Grain Sorghum Export

Japanese traders and their agents continued to try to develop the export of bulk shipments of grain sorghum to Japan; to augment supplies previously drawn from U.S.A., Argentina, Mexico, Cambodia and Thailand. However, N.S.W. and Victoria needs have always exceeded N.S.W. production; thus, grain sorghum exports were of minor dimension until the 1970 crop. This crop exceeded normal domestic needs.

When it was evident that the home market (already depressed by the availability of wheat) could not absorb the excess the newly-formed Australian Coarse Graingrowers' Association and several major grain merchants organized the shipment of 75,000 metric tons of sorghum grain to Japan. A "N.S.W. Grade" was established to ensure that sorghum grain exported was competitive, on the Japanese market, with the major supply of U.S. No. 2 Grade.

The Department of Agriculture co-operated with the Department of Decentralisation and Development, the Department of Trade and Industry, the Department of Railways, Department of Transport and the Grain Elevators Board in an inter-departmental committee on coarse grains; recommending actions in relation to country receival, freight, terminal receival and bulk-loading facilities. Statistics of crop areas and production forecasts maintained by the Division of Plant Industry provided a basis for estimates; meeting each interested section's particular data needs.

The organized marketing had an immediate beneficial effect for growers. It raised the return from the low of $22 to about $28 per ton on the farm.

Grain Sorghum Trials

Hybrid Yield Tests.—A large range of hybrid grain sorghums was tested, in 2 groups, in trials on farmers' properties and at the Leeton, Yanco, Narrabri, Tamworth, Glen Innes and Grafton Agricultural Research Stations. Because of damage by mice and loss by hail, many farmers' trials were lost but results were excellent at Research Stations.

Within their maturity range, most hybrids did well. Popular late maturing hybrids Texas 671, Pacific 579, Pioneer 846 and E57 yielded well, with NK275, Pacific 303 and F65 doing well among the new hybrids. The mid-season hybrids, comprising Texas 610, NK212, Texas 626, C44B and C45 were the most widespread, throughout the State, while slightly earlier types such as Pacific 222, NK200 and NK2204 did well. New hybrids C44C, C42, NK200, NK207 and Pacific 222A were promising in trials.

The very early maturing hybrids Pacific 007, NK133 and X249 yielded well in dryland sowings and proved able to produce moderate yields where moisture was limited.

Fertilizer and Plant Population Studies

At the Leeton and Narrabri Agricultural Research Stations, irrigated grain sorghum trials showed no benefit from plant populations above 120,000/acre. Most hybrids gave depressed yields at 150,000 plants/acre.

Response to applied nitrogen was impressive. Even on soils normally considered to be reasonably fertile a rate of at least 60 lb of N/acre was beneficial. But responses to rates above 120 lb of N/acre did not appear profitable.

There were responses to zinc in the northwest, although sorghum is less sensitive than maize to low levels of this element.

FORAGE SORGHUMS

Production Trends

Because of generally favourable spring conditions, pastures provided abundant forage and forage sorghums tended to be omitted from seasonal sowings. Even so, sowings were estimated to exceed 50,000 acres; similar to the general level of recent years. Hybrid types remained most popular but there was keen interest in open-pollinated sudan grasses in the northwest, and increased interest in open-pollinated sweet sorghums for winter cattle-feed.

New Hybrids

New hybrids continued to be released by commercial breeders and 4 were submitted to Departmental trials. Bonanza, Sordan R, Sudax 6 and FS26 gave similar yields to established hybrids such as Zulu, Sudax Sx11A, Forager and, in silage-makine types, to FS22A.

MILLETS

Broom Millet

Acreage and Production.—The 1,550 acres of broom millet grown in 1969–70 was only 66 per cent of the area grown in the previous season. Estimated production, 530 short tons, was 420 tons less than that of the previous year. Again 75 per cent of the crop was grown in the Tumut/Gundagai area; the rest in the Lismore area.

Introductions.—Eight introductions of standard broom millet were grown at Glen Innes Agricultural Research Station. All were inferior to the present strain of White Italian selected by the Department.

Fodder and Grain Millets

Japanese and Siberian millets (*Echinochloa crusgalli* varieties) were used in small individual areas in all parts of the State, for summer forage.

The pearl millet Tamworth, released by the Department, increased rapidly in popularity as seed stocks became available. The area sown exceeded 5,000 acres. At least half of this was intended for seed harvest. Yields of 1,000 to 1,500 lb of seed/acre were had in some areas.

The forage yield of Tamworth pearl millet was slightly less than leading hybrid forage sorghums, but Tamworth is becoming popular as the production periods are similar *and* there is no danger of hydrocyanic acid poisoning.

A sterile, perennial interspecific cross between pearl millet (*Pennisetum typhoides*) and elephant grass (*P. purpureum*), developed by the University of Sydney, was observed, under trial conditions.

Of the grain millets, the area of *Setaria italica* ("Panicum") exceeded 1,000 acres. But yields were low; only 200 to 250 ton of seed was produced. Sowings of 350 to 400 acres of White French millet produced only 80 to 100 ton of seed.

RICE

Acreage and Production

Rice area increased by about 14,000 acres, from 82,710 harvested in 1968–69 to nearly 97,000 in 1969–70. This reflected the increase to 30 acres in minimum allocation for rice growing and the allocation of rice areas to new farms in the Coleambally Irrigation Area. The number of farms on which rice was grown rose to 1,508, and the number of growers (including share farmers) increased to about 1,830.

Wet spring conditions disrupted and delayed rice sowings and the application of water. This, followed by cold during flowering in February, caused a higher than normal percentage of empty glumes and adversely affected yield. The mice plague in autumn further reduced the yield.

Final figures are not yet available but total receivals had reached 239,528 tons at the date of preparation of this report. From 96,584 acres, a yield average of 2·48 tons/acre is calculated; the lowest since 1964–65.

Though delayed, harvesting was not as prolonged as in 1969. Drying out was slow in April. This did not encourage farmers to take advantage of the incentive payments and premiums introduced in 1970 by the Rice Marketing Board.

Premium and Incentive Payments Introduced

With the establishment of an "Appraisal Laboratory", rice was sampled on delivery and the sample was test-milled. Following this a premium or discount was applied, according to the whole grain "mill out" percentage.

Similarly, incentive payments were made for delivery of paddy rice coming within moisture range 16·5 to 22·5 per cent if delivered before a specified date. This was to encourage early delivery: conducive to higher quality and better whole-grain "mill outs".

Rice Establishment Delayed

Sowings were delayed by wet weather early which hampered cultivation, grading and bank construction. So most sowings were about 2 weeks late. Weather in the more northern rice growing area encouraged barnyard grass development but inhibited normal herbicide treatment—causing some chemicals to be applied in the permanent irrigation water rather than to the soil surface. This change was largely satisfactory, although crop establishment was delayed.

Rice Variety Popularities

Calrose continued to be the most popular variety, primarily because of better adaptability to a range of environmental conditions. Acreage of the long grain variety Kulu increased in 1969–70, whilst Caloro acreage again fell.

Liaison with the Rice Industry

Close liaison with the rice industry continued; exemplified by the schools conducted in the Murray Valley for rice growers, especially for new growers, the successful field days at Yanco Agricultural College and Research Station and in the Coleambally Irrigation Area and the Deniliquin district.

The Irrigation Research and Extension Committee's Research Soil Testing and Rice Investigations Sub-Committees continued to suggest and review research and extension activities relating to nitrogen soil testing for rice and the overall programme of rice research.

Rice Breeding and Improvement Programme

The rice breeding and improvement programme was maintained by the second rice breeder whilst the senior breeder continued post-graduate studies in the U.S.A.

Primary object of the breeding programme is to produce improved long, medium, and short grained varieties—of maturity to suit the soil and growing conditions of the major areas; the Murrumbidgee, Coleambally, and Murray irrigation regions.

For the first time, some of the breeding was conducted on part of the CSIRO Field Station at Deniliquin. The field management was carried out by CSIRO staff, whilst establishment, selection and harvesting operations were directly controlled by the rice breeder.

Six advanced lines were selected for increase on a semi-commercial basis, so that they may be evaluated for milling quality and market acceptance. The lines concerned are the long grain types YR6.54.10.5, YR6.54.10.7, YR13.89.9, and YR13.89.11, the medium grain YR6.100.9, and the short grain glutinous YR140.

The programme has been sufficiently broad to permit some flexibility in the final release decisions. These will depend on market opportunities and trends. In this regard, promising selections may be held in cold storage if necessary.

A feature of the 1969–70 season was the interest attracted by the short grain glutinous YR140 line which may prove to be in demand.

Rice Agronomy Research

Besides variety testing, research continued into: interactions between varieties, nitrogen rates, and methods of sowing; nitrogen sources and rates; placement of nitrogen; use of slow-release type nitrogen fertilizers, and of inhibitors to delay nitrogen release; and interactions of trace elements with sulphate of ammonia and superphosphate.

Greater attention was given to investigating the timing and rates of nitrogen application, and the use of an inhibitor to nitrogen release.

Preliminary investigations were undertaken as to the possibility of foliage dessication as an aid to harvesting.

Rice Soil Testing Service

For the 1969 sowing the Rice Soil Testing Sub-Committee of the Irrigation Research and Extension Committee (I.R.E.C.) extended the existing soil testing service to all rice growers wishing to avail themselves of it. This service was operated through Australian Fertilizers Ltd (A.F.L.).

Test reports provided a soil nitrogen figure, but did not recommend a nitrogen application rate. Instead the grower was advised to consult his District Agronomist who, on the basis of the report, recommended a nitrogen application rate. This practice was because of factors that complicate the interpretation of test results.

Miscellaneous Crops

PULSE CROPS

To compensate for restrictions on wheat, through quotas, and their reduced farm incomes, farmers showed increased interest in diversification by trying pulse crops.

Field Peas

The area of field peas sown in 1970 has been estimated to exceed 3,500 acres; with large areas for seed production in the Wagga Wagga and Inverell areas. Yields of 20 to 30 bushels/acre were had from smaller areas sown in 1969.

Lupins

Release of the variety Uniwhite by the University of Western Australia has opened a new field of pulse production. This was the first of the alkaloid-free lupins holding the seed in the pods well enough to permit direct heading. Later releases, Uniharvest and Unicrop, have both shown improvement in seed retention, and Unicrop is earlier in maturity.

Sowings of Uniwhite in 1969 were limited by rate of availability of seed. But in autumn 1970, seed sales indicated that about 2,000 acres were sown—mainly in southern areas. Yields of 18 to 30 bushels/acre are expected.

Cowpeas and Mungbeans

Grown on the coast mainly for green feed, and inland for green feed and seed, cowpeas occupied 21,000 acres. Small reductions in area occurred in the Coonabarabran area, and on the coast—where lab lab bean supplemented cowpeas. By contrast, in the Inverell district successful negotiations for sale of cowpeas on the overseas market led to a 166 per cent increase in area.

The mungbean cultivar, Celera, released in 1969 by the Department, closely resembles the cowpea. But it is much earlier, more consistently upright in habit, and retains its seed well for machine harvest.

A further mungbean cultivar, Berken, used for culinary purposes, was under test in the pas year.

Tick or Horse Beans (Vicia faba)

There was a limited market, for race-horse feeding. Imports were priced as high as $125/ton. An area grown in New South Wales produced 18 bushels/acre.

Because of dearth of varieties here, 7 lines of winter and spring types have been introduced from the U.K. and Europe for testing.

COTTON

Production Trends

Reduced Production.—The 1969–70 area of cotton in New South Wales was estimated at 60,700 acres (compared with 60,787 in 1968–69) and production at about 99,000 bales. Per acre yield average approximated 1·6 bales; some 16 per cent below the 1968–69 yield average. Cool and wet spring conditions had delayed cotton establishment and retarded early growth. Then followed a relatively cool summer and subsequent early frosts in the main production area. These circumstances were primarily responsible for the low yield average.

The Namoi Valley.—This was again the major producing region. The estimated 50,000 acres produced some 85,000 bales, at a yield average of 1·7 bales/acre.

The Macquarie Valley-Bourke Area.—Cotton sown in this region increased again, from 5,416 acres in 1967–68 and 8,084 in 1968–69 to about 10,600 acres in 1969–70. Estimated production was 14,000 bales at a yield average of about 1·3 bales/acre. Unfortunately, some was established late and in due course was seriously affected by early frosts.

Of the total, 985 acres was sown in the Bourke district and most of this area yielded about 2 bales/acre. In the Macquarie Valley 1,100 acres was sown, as "narrow row" cotton mainly at 7 in row spacing. Harvesting here was late and there was also mice injury to seed and fibre, but the yields overall were considered satisfactory.

South Western Districts.—Cotton sowings in the southwest fell sharply to 57 acres, as against 700 acres in the previous year.

Cotton Bounty

The total of bounty payments in 1970 to Australian growers fell, from the $4 million of previous years, to $3 million. This reflected the Commonwealth Government's plan to reduce bounty payments on cotton to a final $2 million in 1971.

Cotton Export

The first substantial exports of cotton since about 100 years ago were made in 1969–70. Some 36,000 bales were exported from Australia in the first 7 months of the 1969 sales year.

Cotton Varieties

Deltapine Smooth Leaf continued to be the most important one grown in New South Wales. Stoneville 7-02 popularity further diminished but Hopicala acreage increased in the Namoi Valley. Hopicala fibre characteristics have led growers to hope that this variety will enable production of a longer and stronger fibre than that of Deltapine Smooth Leaf, and thus further reduce the importation of raw cotton. However, longer experience with Hopicala is still required—especially regarding its reaction to disease.

Two new varieties were released by the CSIRO; Riverina Gold Open Boll, and Riverina Gold Storm Resistant. These have yet to be widely tested in New South Wales.

Advanced variety testing was conducted at 3 sites in the Namoi Valley and 2 in the Murrumbidgee Irrigation Areas. Seasonal conditions prevented sowing of intended trials in the Macquarie Valley.

In the Namoi Valley trials, Deltapine Smooth Leaf again showed its yield superiority. The Murrumbidgee Irrigation Area trials were sown both on the normal 40 in row-spacing and the narrow-row spacing of 7 in. Because of poor establishment of some varieties these M.I.A. trials did not produce useful data.

Cotton Breeding, Improvement and Quarantine

The cotton breeding programme was maintained throughout the year as a full project; with complete crossbreeding, selection, and testing programmes. Thirty-seven cultivars were tested at the Stage I level, compared to the 31 in 1968–69 from which 12 were recommended for Stage II testing in 1969–70. The *Verticillium*-wilt resistance work proceeded satisfactorily and 3 lines were selected for further examination.

Pure-seed increase for all stages of testing was continued, and additional varieties were grown under quaratine at Glen Innes.

"Fibre Research Laboratory"

Approval was granted early in the year for the intended "Cotton Fibre Testing Laboratory" to be re-designated "Fibre Research Laboratory", since the laboratory might ultimately be concerned with fibres other than cotton.

The absence of suitable laboratory premises and facilities has continued to limit the volume of work and number of staff that may be employed in fibre testing. Plans were made during the year for provision of improved but, even so, temporary facilities. However, there have been delays in the delivery of equipment from the U.S.A. and the situation remained as in 1968–69 except for the prospect that the interim expanded-facilities may be available by the end of 1970.

The Department acknowledges again the continued co-operation of the University of New South Wales and Bradmill Industries in providing air-conditioned laboratory space. In spite of their generous actions, critical delays in testing high-priority plant breeding material are inevitable—pending provision of the Department's needed facilities.

Cotton Production Research

The Officer for cotton nutrition research at Narrabri travelled to the U.S.A. for post-graduate training, but the programme of field work concerned with nitrogen and phosphorus continued. In the south, the investigation of cotton response to gypsum continued. Other experiments are investigating the effects of: defoliation through insect attack; plant population and arrangement; row spacing and population; and a preceding rice crop, on narrow-row cotton production.

TOBACCO

Production and Trends

The New South Wales quota of green leaf was again increased for the past season, to 3·078 million lb. The area planted rose to about 2,740 acres an increase of 50 per cent over 1967–68 and 25 per cent over 1968–69, and is estimated to have produced about 3 million lb. of green leaf. Yield average was estimated at 1,100 lb/acre; slightly less than in the previous 2 years.

Acreage expansion was greatest in the main, northern tobacco growing areas. But proportionately there was greater increase in southern border districts. A further development was the initiation of tobacco growing in the Coraki district, on the north coast. In the south the crop was grown also in the Culcairn, Corowa, and Upper Murray districts.

Tobacco Extension Work

The Department undertook at the 19th meeting of the N.S.W. Advisory Committee to conduct a planned extension programme during 1969–70. Three visits to each tobacco farm during the growing season was to be a key component.

As was envisaged, the initiation of this programme created a demand for additional visits which the officers were unable to satisfy. At the 21st meeting of the N.S.W. Tobacco Advisory Committee in April, 1970, the Department agreed to the principle of establishing advisory positions to be occupied by persons experienced in tobacco growing to make farm visits and provide information to growers.

Actually only 2 officers were engaged on tobacco research and extension. They made over 300 farm visits, collected 174 soil samples for analysis by the Northgate Laboratory, conducted a field day on labour reducing practices, presented 9 news releases, and analysed 23 water samples. They conducted research programmes and made interstate visits; studying tobacco growing mechanization, research planning and research methods, and attending tobacco sales.

Tobacco Research Facilities

Alterations and additions have been made to the facilities at Glen Innes: glasshouse heating and lighting, renovations to offices, and construction of a new storage and work shed.

Tobacco Research

Investigations were conducted into: hormone injury due to picloram, improved methods of seedling production, nutrition (nitrogen), variety potential, transplanting methods, time and motion studies concerning harvest and post-harvest operations, and the use of hinged sticks for curing.

The research showed that picloram use has not created a serious problem for tobacco growers, but an awareness of its potential to do so (as in the case of other hormone herbicides) must be maintained. Valuable extension information was had from the seedling-production research. Investigations of transplanting showed that peat-pelleted seedlings when transplanted received very little growth-check. Time and motion studies showed that a tying machine reduced the total time at harvest, and reduced by about half the percentage of total time spent on "handing and tying". Investigations into hinged sticks showed, in a preliminary trial, that bigger loads could be put into tobacco kilns.

LINSEED

Increased Acreage and Production

The New South Wales area of linseed expanded to a record 50,000 acres in 1969–70; more than double the previous record area in 1964–65, and a direct effect of the introduction of wheat quotas. Production approximated 17,500 tons, averaging about 14 bushels/acre. That yield average ranks high for New South Wales.

Acreage and production have been most stable in northwestern areas of New South Wales. In 1969–70 large acreages were sown in the Condobolin, Warren, and Parkes districts. In several other parts of the State, not previously recorded as linseed growing districts, areas of up to 1,500 acres were sown.

Because of the stable domestic demand for linseed oil (used only for industrial purposes) not all applicants for contracts to grow linseed received an allocation. In previous years only one processor offered contracts but this season a second processor offered contracts.

Interest in the possibility of exporting linseed or linseed oil developed, but no export was reported. For an export trade to develop the price-yield relationship must be such that returns will at least approach those from wheat.

OILSEED RAPE

New Production Trend

Rapeseed oil has been used increasingly in Australia in recent years, primarily for edible purposes. Only a very small quantity is being used industrially. Until this year there was no record of oilseed rape being produced in New South Wales, although there had been production in Victoria. This season some 2,200 acres were grown in New South Wales and produced about 700 tons of seed; a yield average of $\frac{1}{3}$ ton/acre. Considerable expansion also occurred in Victoria and Western Australia.

At the end of the year under review, farmers intentions were to sow 50,000 or more acres of oilseed rape in New South Wales. The future prospects for this crop are most promising in the more reliable wheat areas, with cooler and moister conditions, and also in tableland districts.

SAFFLOWER

Production Trends

On information from District Agronomists it is estimated that some 17,000 acres was sown to safflower in 1970. There have been big fluctuations in area in recent years, as shown: 113 acres in 1964; 2,253 in 1965; 2,539 in 1966; 5,092 in 1967; 8,550 in 1968; 2,415 in 1969, and 17,000 in 1970.

1969-70 was the most successful safflower season for some time. The 12-year yield average for New South Wales up to 30th June, 1968 was 9·3 bushels/acre. The 1969–70 yield average was estimated at 16 bushels/acre, despite substantial losses due to root rot (*Phytophthora*) on heavy soils in the central west. The spring conditions, favoured high yields in most areas. For example, October rainfalls were extremely high in the central west and with further above-average rainfall in November provided the conditions for high yields on well drained soils.

Northwestern districts had previously been the leading production area but grew a relatively small proportion of the 1969–70 crop. Most of the acreage was sown in the central west, and a lesser area in the eastern Riverina.

SOYBEANS

Greater Acreage but Low Production

Soybean acreage in New South Wales again rose in 1969–70. The trends over the past 7 seasons have been as follows: 100 acres in 1964; 202 in 1965; not known in 1966; 191 in 1967; 600 in 1968; 1,370 in 1969, and 9,000 in 1970.

In spite of the expanded acreage in 1969–70, production was low. The estimated yield average was 15 bushels/acre.

About 20 per cent of the area sown did not establish—because of faulty germinations, bad irrigation layout and water management. Many stands were thin because of poor quality seed. In other cases the growers had ignored the need to sow at the correct time.

Especially in the central west, and to some extent in the southwest, mice attacked soybean crops at the pod filling stage and seriously reduced the yields.

Soybean Research

Co-operative Programme.—A comprehensive programme of research and testing was continued; involving co-operation between Narrabri Agricultural Research Station (the soybean breeding centre in New South Wales), the University of Queensland and University of Sydney, the Leeton and Glen Innes Agricultural Research Stations, and 12 District Agronomists.

Breeding and Introductions.—The hill plot testing programme conducted in 1968–69 provided the base for selection of further parents and of row testing for 1969–70.

Further crosses were made and segregating populations were advanced up to the F_5 generation by single seed descent.

A series of 7 evaluation trials to provided data on a standard group of 12 varieties was arranged through University and intra-Departmental co-operators. The series covers latitudes from Milmerran in Queensland, to Narromine and Camden in New South Wales. The trials confirmed the value of the varieties Lee, Hill, and Bragg.

Variety Trials.—Variety testing was expanded so that apart from 3 special semi-commercial comparisons of Lee and Bragg in the Gwydir, Namoi and Macquarie Valleys, 14 variety trials were laid down from Glen Innes and Moree in the northern part of the State to Finley and Deniliquin in the south.

The testing confirmed that Bragg is adapted to the Moree and Narrabri/Wee Waa districts, and that Lee is widely adapted to the area bounded by the Namoi in the north and the Coleambally Irrigation Area in the south. The variety Hill, while inferior to Lee and Bragg in the Wee Waa/ Narrabri area, may be valuable in the upper Namoi. Hill has done well from the Macquarie Valley to the Coleambally Irrigation Area, and even to the Murray Valley. Bethel also has performed satisfactorily in the southern irrigation areas and districts.

Other Research.—Investigations continued into row spacings x population, time of sowing x variety, prevention of insect damage, and nodulation. Experiments in co-operation with the Biology Branch investigated the effectiveness of *Rhizobium* strains.

A preliminary investigation of genetic/zinc deficiency relationship in the variety Roanoke, as compared with the variety Lee, was undertaken.

Soybean Pure Seed Production

Plans were made previously for a pure-seed production programme. Initial work has been done by the plant breeder but in order to provide a nucleus of quality seed (pending availability of seed from the proposed programme) ½ ton of pure Lee and 300 lb of pure Bragg were grown by farmers in 1969–70, under supervision. Further releases, greater than in 1969, will be made in 1970 as an interim measure.

SUNFLOWER

Rapidly Increasing Acreage

The rapid expansion of acreage of this oilseed crop is apparent in the following figures: 50 acres in 1964; 89 in 1965; 156 in 1966; 1,025 in 1967; 638 in 1968; 4,400 in 1969; 37,000 in 1970.

In 1969–70 most of the acreage was irrigated; probably 60 per cent. Even so, yields were low and mainly because mice severely damaged large acreages and completely destroyed some areas. Also: poor irrigation layout and management caused losses due to waterlogging; late sowings developed poorly and suffered more from disease than the earlier ones. The yield average is estimated to have been between 400 and 500 lb/acre.

Sunflower Research

Investigations continued into varieties, plant population and fertilizer needs under irrigation, and in general confirmed earlier results.

An encouraging feature of the 1969–70 variety testing was that better yields were had at all experimental sites. The best was 2,850 lb/acre in trails at Narrabri Agricultural Research Station.

CANARY SEED

Attention in New South Wales

Canary seed, usually considered a Queensland crop and grown little in New South Wales, attracted attention in 1969. During the pre-sowing period, canary seed prices on the London market briefly exceeded £200 stg/ton. As a direct result more than 6,000 acres were sown in New South Wales. Half of this acreage was in the Inverell district. District yield average varied up to 18 bushels/acre. Individual crops notably exceeded this under seasonal conditions.

Following a substantial drop in London prices, less interest was apparent at the 1970 pre-sowing period.

Vegetables Work

GENERAL

Australian Vegetable Research Conference, 1969

New South Wales was host State to the 1969 Australian Vegetable Research Conference, held at Terrigal, 24th to 28th November, 1969. Attendance comprised 74 official delegates from States of Australia and New Zealand. The bound copy of the Conference Working Papers has become a most valuable reference for the vegetable industry.

Dr J. K. A. Bleasdale, National Vegetable Station, Wellesbourne, Warwick, U.K. was guest speaker. He in his planned itinerary also addressed farmers, Departmental officers, and interested groups. His special knowledge on plant spacing and physiology has been of great value to vegetable research both in New South Wales and other states.

Over Supply and Low Prices

Normal weather prevailed during the growing season in most eastern Australian areas where vegetables are grown for the fresh market. Without an erratic seasonal pattern to restrict yields, and because many landholders sought to diversify from mono-crop farming into vegetable growing, there has been heavy production of seasonal vegetables—with consequent over-supply and low prices. Growers in favoured climatic localities who concentrate on out-of-season produce have received reasonable returns for their specialised lines.

Trends of Location

Stringless French Bean growing increased in the north, where contract growing for two processors is expanding. Due to the north's extended production season, and use of summer-death resistant varieties, losses to this disease were largely avoided.

In the central west, a westward trend of crucifer growing for processing became evident. This trend was partly to alleviate the problem of clubroot at Bathurst but also reflected the increased irrigation farming in new areas. A similar westward movement of production of a wide range of vegetables was apparent in the north west. Whether this will be a permanent feature or is merely a temporary adjustment is not yet apparent.

Large scale tomato production for processing was undertaken in the Quirindi area for the first time, with excellent results. This, coupled with onion and bean planting projects in the northwest, indicates changing locational patterns.

Large Scale Mechanical Production

Mechanical production methods advanced. Tomato, bean, and asparagus harvesters operated at former and new centres. Carrots also, in major producing areas, are being more extensively harvested by machines.

POTATO WORK

Research continued at the Glen Innes and Orange Agricultural Research Stations. At Glen Innes emphasis was onbreeding for high quality as well as good field characters. At Orange the work concerned factors at harvest and in storage affecting culinary quality, and advanced testing of intoduced varieties and new lines.

Breeding

The Crossing Programme.—This year 1,016 crosses were made at Glen Innes and some 300 were successful, producing 1,155 berries. Fifty-five male and 48 female parents were used in various combinations. Those used for the first time included Wyred, Alamo, and Wauseon from the U.S.A., and Lorch, Ekaterinisky and Pziekulskiz Znnij from the U.S.S.R. The wild species *Solanum stoloniferum* was successfully crossed with both Late Katahdin and Merrimack.

First Year Seedlings.—Some 232 first year seedling lines were grown in the glasshouse. Included were 26 *Solanum andigena* lines imported as true seed from the U.S.A. and five lines of locally crossed *Solanum stoloniferum* x *S. tuberosa* hybrids.

At the Orange Agricultural Research Station, 572 first year seedlings were grown in the glasshouse from seed procured by an officer who made an overseas study tour in 1968.

Second Year Seedlings.—From the second year material, 20,400 individual seedlings grown at the Clairvaux Sub-station are yet to be lifted and selected. Or about 18,000 1968–69 second year seedlings lifted and selected in July, 1969, some 697 selections were made. The parental varieties Superior, F4724, Ona, S2898 and S2897 produced promising material.

Sixty-two seedlings of second year material from Glen Innes were grown in a yield trial at Orange Agricultural Research Station and five have been retained for further testing.

Third Year Seedlings.—697 third year seedling lines were grown but these, although harvested, have not yet been selected. Of the 1968–69 third year seedlings selected in July, 1969 some 576 were grown this season at the Sub-station. Of the 163 lines retained, 10 showed good potential.

Fourth Year Seedlings.—At the Red Range Sub-station, 163 fourth year seedlings were grown and harvested, and await selection for tuber quality. From the 198 fourth year seedlings chosen in 1968–69, some 43 selections were included in preliminary yield trials. These replicated trials await harvesting and selection, but 10 of the lines appeared promising. From the preliminary yield trials of 1968–69, some 14 lines were selected for advanced yield trials. Several of these from the cross S2897 x S2898 show considerable promise.

Advanced Yield Trials.—Advanced yield trials were again done at Orange Agricultural Research Station and in 6 district locations. In these trials 20 entries were compared, including seedling lines and named varieties. The results have yet to be finalized.

Potato Quality Studies at Orange Agricultural Research Stations

Quality studies continued, including assessment of the role of specific gravity and reducing sugars; also crisping trials.

Techniques to determine the role of specific gravity and reducing sugars needed modification, to permit valid comparisons of different varieties stored under various temperature regimes in the controlled environment cabinets. Installation of the cabinets is now almost complete.

Seed Production at Orange Agricultural Research Station

Thirty-four varieties and seedlings were maintained. Severe mid-season aphid infestation necessitated early removal of top growth. Leaf roll, a virus transmitted by aphids, has been of constant concern in seed crops. The various aspects of this problem (including incidence of aphid flights, effective aphid control measures, period of incubation of the disease, and detection of late infestations) were closely studied.

Commercial Potato Seed Production

Under the Potato Seed Certification Scheme, 1,184 acres were submitted by 99 growers. Of the total area submitted, 1,090 acres was passed for certification. Rejection rate was 8 per cent. In the previous season 1,336 acres submitted by 129 growers had been accepted for certification.

The Approved Seed Scheme's expansion in the previous year led to representations from Certified Seed growers to restrict production of Approved Seed. This led to increased charges (for inspections of both the growing crop and the tubers), the compulsory use of new bags, and an acreage restriction on Approved Seed growers (based on the previous season's sowings). Thirty-seven growers of Approved Seed submitted 473½ acres; as against the previous year's 44 growers, 651 acres. This year the total of areas passed was 428½ acres. Rejection rate approximated 10 per cent.

TOMATO WORK

Breeding Programme

Two New Varieties for Canning Industry.—Two varieties specially bred at Yanco Agricultural Research Station for the canning industry were released—under the names "YRF No. 2" and "YRF No. 3". Incorporating resistance to *Fusarium*-wilt, freedom from green shoulder, and resistance to skin cracking and blossom end rot, the two were selected from the cross Roma 844 x No. 255. Because of small bush character and concentrated fruit set, the varieties are suited to either mechanical or hand harvesting.

Improving Tomatoes for the Fresh Market.—The breeding programme at Hawkesbury Agricultural College is aimed at improving tomatoes for the fresh market by incorporating resistance to *Fusarium* and *Verticil ium* wilts and to eelworm. F1 hybirds, fixed varieties and crossbred material were assessed in a spring trial at the College and in observation plots at Murwillumbah and Gosford.

Over 150 lines were tested for yield, skin-crack resistance and quality.

Tomato Variety Trials

Two years' trials of new and established varieties at Hawkesbury Agricultural College have shown that although the more recent varieties Indian River, Manipal, Floralou, and Floradel produce somewhat more early fruit the old established variety Grosse Lisse still totals more fruit over the season.

Field trials with processing varieties bred at Yanco Agricultural College and Research Station were conducted by commercial growers in the M.I.A. and by a processing firm at Cowra.

Tomato Production Trends

The production of tomatoes for processing extended to new districts including Dubbo, Narromine, and Quirindi. A yield of over 20 ton/acre was recorded at Quirindi. Two growers in the M.I.A. established large-scale tomato crops, but adverse weather at harvest caused serious losses.

Plastic Covering for Trellised Tomatoes

Demonstrations (C.E.S.G.) of plastic covering for trellised tomatoes were started at Murwillumbah and Gosford. Trials at Alstonville Tropical Fruit Research Station showed that, with the aid of plastic, smooth skinned tomato varieties can set fruit during the winter.

BEAN WORK

Summer-Death Resistance Programme

The need for resistance to summer-death disease led to the testing at Yanco Agricultural College and Research Station of over 200 varieties and advanced breeding lines from overseas.

This work, co-operative with the Biological and Chemical Research Institute, Rydalmere, revealed that Apollo has great promise as a resistant stringless dwarf variety. Apollo was introduced by the Department from the United States Department of Agriculture. Seed firms and processors have arranged seed-increase, in order that it can be used as soon as possible for snap freezing and canning. Apollo equals or betters the quality of the commercially-grown Gallatin 50 and Tendergreen. It also shows great promise as a stringless variety for the fresh market.

Breeding for French Bean Improvement

The breeding programme's object is to improve the quality of stringless and stringed beans for processors and the fresh market. The programme also seeks resistance or good field tolerance to rust, anthracnose, summer death and, to some extent, halo blight.

In field tests at Hawkesbury Agricultural College and at Yanco Agricultural and Research Station, seven lines from U.S.A. showed complete resistance to summer death and good field tolerance to rust.

In conjunction with Gordon Edgell Pty Ltd, a stringless dwarf bean variety and quality trial was conducted at Hawkesbury College. Ten new introductions and the commercial varieties Gallatin 50 and Tendergreen were compared in it. Cascade and Apollo and the fixed breeding lines Ida 83-4588, Ida 83-4590, Ida 83-4591, and Greenpod 11-39 were superior in yield to Gallatin 50 and Tendergreen. Apollo, Idachief, and Wondergreen and the fixed breeding lines Ida 83-4588, Ida 83-4590, and Ida 83-4591 all exhibited superior quality.

District variety trials were conducted in the Murwillumbah and Gosford districts. At Gosford the extremely wet spring caused loss of the trial. At Murwillumbah the variety Leeton showed promise in mid-winter sowings and will be re-included in the ensuing year's trials.

Bean Seed Certification Scheme

Acreage submitted for certification fell from 58 acres in 1968–69 to 37 this season. Yield from the three growers' crops submitted will approximate 487 bushels.

Possible Re-Expansion of Bean Growing in New South Wales

Because of the extreme summer-death problem the industry had moved to the southern States. This season a northward movement of stringless bean growing for processing was apparent. At least two processors arranged contracts with growers to sow over 1,000 acres of stringless beans. As a result of the Department's work in locating commercially acceptable summer-death resistant stringless varieties, the industry will recover importance in this State.

ROCKMELON WORK

Small areas of Yanco Treat and Yanco Delight were grown for seed-increase, and selection in this cross-pollinated crop was continued—to maintain the resistance to *Fusarium*-wilt and powdery mildew.

Somewhat reduced acreage was sown to rockmelons in the M.I.A. But the crop was grown on a substantial scale in the Bourke area for the first time.

ASPARAGUS WORK

Fusarium-resistant strains continued to give good results in trials and commercial areas of asparagus grown by the Gundagai Asparagus Co-operative. The strains have been adopted for all commercial plantings.

Trials with establishment-practices were started. These include close spacing within and between rows, double row planting and direct seeding; because variations to existing wide row spacings will be needed for best use of the 11 mechanical harvesters imported by the Co-operative.

LETTUCE WORK

Two hundred acres of lettuce for seed were grown near Griffith and produced a high yield of good quality seed. Seed also was produced at Barham, but the 40 acre crop was affected by poor weather at harvest.

CRUCIFER WORK

Brussels Sprouts.—Several lines of Brussels sprouts were introduced for trial but the seed arrived late. The trial, sown by a commercial grower near Bathurst, has not yet been harvested.

Hybrid Cabbage.—At Hawkesbury Agricultural College, trials with the hybrid cabbage "Sanibel" indicate a very uniform maturity. The entire crop was harvested in a two weeks period.

Pastures Work

ELEVENTH INTERNATIONAL GRASSLAND CONGRESS

Thirty-eight N.S.W. Department of Agriculture officers attended the 11th International Grassland Congress, the first to be held in Australia. Eight papers were presented by Division of Plant Industry officers, and a further four papers by officers of other Divisions. A pre-Congress tour arranged by the N.S.W. Department drew 17 participants, from 11 overseas countries.

PASTURE RESEARCH

Work on Pasture Species and Cultivars

Lucerne (Medicago sativa).—Siro Peruvian lucerne has been found useful for grazing in short-term, 2 or 3 year pastures at Condobolin. At Tamworth and Narrabri the Hunter River variety was the most productive over a longer, 5 year pasture phase. In grazing trials at Cowra, Trangie and Temora, lucerne was killed out quickly under set-stocking. At Temora in a lucerne grazing trial 2 ewes/acre were carried satisfactorily by "set-stocked" lucerne, but a stocking rate of 4 ewes/acre under set-stocking killed out the lucerne in 6 months.

Cancreep lucerne has been found to be persistent under Temora and Narrabri conditions, although total productivity has been less than that of Hunter River.

Subterranean Clover (Trifolium subterraneum).—This has been superior to medics on the more acid loams in the central west.

The inoculum for Woogenellup cultivar has been changed to a new and more effective strain of *Rhizobium*.

In studies at Leeton, Deniliquin and Berry new varieties of *T. subterraneum* sub species *yanninicum* have not yet shown superiority to Yarloop for heavy soils and waterlogged conditions.

On the central coast Clare subterranean clover at a high rate of sowing has been found a useful alternative to oats for winter grazing.

White Clover (Trifolium repens).—White clover continued to be a major legume in coastal, tablelands and irrigation area pastures. Naturalised white clover grown in the Clarence Valley continued to show promise in the Clarence Valley beef research programme. Ladino has been shown to be the best cultivar of white clover in the Berry area, but price of Ladino seed has caused farmers to seek cheaper alternatives for coastal and tableland pasture sowings. Naturalised white clover has persisted in kikuyu grass (*Pennisetum clandestinum*) trials at Berry, despite topdressing with nitrogen at 120 lb/acre and a cutting interval exceeding 6 weeks.

Medics (Medicago spp.).—Medic varieties and establishment practices have featured in the work for the central western plains. Jemalong barrel medic (*M. truncatula*) was again superior on the red soils, white Cyprus barrel medic was superior on heavy black soils. Rose clovers (*T. hirtum*) and subterranean clovers have been better than medics on the intermediate loams. Cyprus barrel and Harbinger strand medics (*M. littoralis*) gave best results in the far western districts. Successes in production of Jemalong barrel medic seed have led to lower prices—thus encouraging farmers to use this promising variety.

Other Legumes.—Rose clover is promising for the loams in the central west and the light soils of the northwest.

Namoi woolly pod vetch (*Vicia dasycarpa*) continued its promise as a regenerating pasture species for a range of coastal, tableland and slopes conditions.

Ball clover (*Trifolium glomeratum*) is now being studied in a co-operative project with the CSIRO, Canberra. Eighty ecotypes collected from New South Wales, along with other overseas introductions of the same widely-naturalised species, are now in small plot trials at Canberra and Yanco.

Phalaris (P. tuberosa).—Hybrid phalaris (Siro 1146) has shown promise; in trials under irrigation at Leeton, under dryland conditions at Cowra, and on the south coast near Berry.

At Leeton, under grazing, "phalaris with clover" outyielded a treatment of "phalaris with nitrogen" when harvested at 21-day intervals. But "phalaris with nitrogen" was superior when intervals of 84 days elapsed between harvests.

In trials between phalaris, cocksfoot and fescue at various nitrogen rates on the southern tablelands, the phalaris was poorest without nitrogen and best with high rates of nitrogen. Of these grasses, the fescue produced most forage in the late winter.

Persistency of Sirocco phalaris through hot dry summer weather has been noted again at Temora.

Ryegrasses (Lolium spp.).—Kangaroo Valley perennial ryegrass persisted better than Victorian at Cowra. Both did well at Temora. U.S.A., Ariki and Ruanui ryegrasses were non-persistent under the same trial conditions.

Wimmera annual ryegrass—with adequate nitrogen—produced the most winter forage at Berry. It equalled oats with nitrogen in the late winter and early spring. Kangaroo Valley perennial ryegrass was a close second to Wimmera annual ryegrass. Findings at Taree were similar, and there the slower feed production of the ryegrass in the early winter (compared with oats) was also noteworthy. Ryegrass and oats, with nitrogen, were equally productive later in the winter and spring at Taree.

In seed production of Kangaroo Valley perennial ryegrass, early August closing of paddocks was found to be best. Nitrogen topdressings in the spring (60 lb N/acre) were also shown to result in higher seed yields.

Cocksfoot (Dactylis glomerata).—Currie and Brignoles cocksfoots have shown promise at Cowra and been persistent in trials at Temora, along with Moroccan varieties. Currie cocksfoot in mixture with crimson clover has been a promising pasture plant for poor skeletal soils on the southern tablelands.

Fescue (Festuca spp.).—Demeter fescue has shown promise at Cowra and on the southern tablelands, particularly for late winter production—superior to phalaris and cocksfoot in this respect.

Other Grasses.—Nitrogen topdressing at 120 lb/acre has increased the grazing season of kikuyu from 7 months to 9½ months on the south coast. Maintenance of white clover in kikuyu under a close-cutting regime and with nitrogen topdressing has also been a feature of the pasture studies at Berry. Kikuyu has not produced as well in cutting-trials at Taree as some other summer-growing grasses, possibly because of individual species reactions to the cutting methods. Comparisons under grazing have been planned.

The Whittet kikuyu grass cultivar was registered and released commercially this year. It bears the name of J.N. Whittet, a former Principal Agronomist (Pastures) of this Department. He was largely responsible for early research into kikuyu varieties in New South Wales.

The cultivar has been tested widely on the coast this year and promises to be more compatible with legumes than is the widely-spread commercial variety. It is a seed-producing variety and will be commercially released as seed.

Secale dalmaticum has been found promising on the southern tablelands. *Agropyron elongatum* and *Puccinellia* sp. have been useful there in reclaiming saline areas in the Yass Valley.

Subtropical Species.—Subtropical legumes have given increased production from dairy cows per unit area at Wollongbar.

Research studies showed that subtropical grasses grew at half-rate when conditions of high evaporation pertained, even though water supply was non-limiting. Temperate grasses did not show such a growth reduction, and therefore would be recommended for use on the north coast in irrigated pastures under high evaporative conditions in spring.

New varieties of *Setaria sp.* have outyielded the "Kazungula" variety on the south coast. These setarias have all been shown to be susceptible to low heights of cutting or grazing. At Taree, Kazangula setaria and Broadleaf paspalum (*P. wettsteinii*) have each given double the yield of kikuyu in cutting trials under irrigation and with high nitrogen applications.

A blight disease caused by *Ascochyta phaseolorum* has attacked *Lotononis* near Grafton. *Lotononis* has shown good promise on sandy soils in beef pasture on the north coast.

Some new species have been promising in early trials at Grafton. *Aeschynomene falcata*, *Stylosanthes guyanensis* and *Cassia rotundifolia* have shown promise under grazing. *Glycine tomentella*, and other native *Glycine* species also gave good yields and persistence in trials at Grafton.

Pasture Species Testing

Officer-training projects in forage ecology with the CSIRO, Canberra, have fostered the development of a philosophy of pasture species testing which can be applied at appropriate centres and in various environments.

A useful method to estimate visually the pasture species composition of pastures has been developed at Trangie.

Oat varieties for feed-year grazing have been tested in many districts. At Maitland, the useful varieties have been divided into "early", "late", and "whole period" production groups for recommendations. At Leeton, under irrigation, alternative use of grazing oats increased available pasture and ewe body weights; however wool and lamb production were unaffected. At Glen Innes, grazing oats could not prevent liveweight loss of sheep at the start of winter but permitted a liveweight increase at the end of the winter. On the southern tablelands, sowing rates of 3 and 4 bushels/acre of oats, when topdressed with nitrogen, gave increased yields compared with lighter sowing rates. On the northern tablelands, oats with nitrogen gave better production and sheep liveweights than did rape or woolly pod vetch grazed during winter.

A forage crop rotation, forage sorghum and oats, each with adequate nitrogen, has been maintained satisfactorily for three years near Maitland—although soil structure has shown some deterioration.

Plant Nutrition Work

Phosphorus.—On the central western plains, residual effects of superphosphate from initial applications at time of sowing have been found to last for at least 2 years in the production of pasture legumes. Still longer residual effects have been observed in relation to persistence.

On the southern tablelands, deep placement of phosphorus into the sub-soil moisture 3 to 4 inches below the surface of poor skeletal soils has promoted better growth than does a topdressing.

On the northern tablelands, at Shannon Vale Nutrition Station, grazing trials have suggested that because of recycling of nutrients heavier grazing rates need less maintenance superphosphate. Superphosphate 56 lb acre year has been enough to maintain phalaris-white clover pastures for rates of 4, 8 and 12 mature wethers/acre.

At Grafton, native legumes' response to phosphorus has equalled that of introduced legumes, in percentage of increased growth.

Research Agronomists, in particular those on the coast and in the central west, and chemists have co-operatively developed soil tests for phosphorus levels for establishment and maintenance of pasture species. Similar studies have sought plant phosphorus tests to detect phosphorus deficiencies.

Phosphorus has been found necessary for pasture growth in many areas. At Nowra, adequate phosphorus has been proved essential to swamp reclamation projects.

For a Yass River soil very deficient in phosphorus, nitrogen, and organic matter, a high phosphorus sorption has been shown. On such soils, lucerne and phalaris growth has been affected by aluminium toxicity.

On northern tableland farms, superphosphate has promoted increased clover production, as revealed in a survey of bloat incidence and the factors promoting it. A higher rate of superphosphate (3 cwt/acre/year) has promoted passage of the pasture through the clover-dominant stage to grass-dominance within 3 years, whereas lower rates have held the pastures in clover-dominance longer.

Soil Acidity and Lime.—On the north coast, glycine has responded to lime at a pH below 5·5 whereas kikuyu has responded at a pH below 5·0. At Cowra, reasons are being sought for the response to lime by pastures after 1 ton of superphosphate has been topdressed over some years. At Berry, the lime needs of south coast and tablelands pastures are being studied; undisturbed cores of pasture from selected areas are being grown under controlled watering and common climatic conditions. The South Coast Agricultural Research and Extension Council has sponsored and financially supported this lime research. Lime has been shown necessary for legume and grass growth on the swamp soils of the Shoalhaven flats, and for pasture establishment on the poor skeletal soils of the southern tablelands.

Thirty-two acid soils from various areas have been tested in glasshouse trials; 19 are showing severe aluminium toxicity with resultant prevention of lucerne growth. Manganese toxicity occurred in 2 of the soils with a similar restriction of lucerne growth. Both lucerne and phalaris were affected by aluminium toxicity on Yass River soils tested in detail.

Reasons for the lime responses were studied. Calcium and sulphur contents of the soil solution were shown to increase when lime was applied, but many other elements were reduced in percentage in the soil solution. Responses to lime were closely correlated with the calcium chloride extracts from soils. The calcium chloride pH test was found to be unaffected by calcium sulphate or superphosphate, whereas water pH tests were greatly reduced by both of those fertilizers. Results suggest that soil aluminium toxicity to plants can effectively prevent their establishment.

Nitrogen.—At Wollongbar, nitrogen topdressing on kikuyu grass pastures greatly increased butterfat production per unit area in a grazing trial. At the same centre the response to nitrogen has been measured also in terms of beef production at various stocking rates.

On the northern tablelands in grass-clover balance studies concerned with the incidence of bloat, high rates of nitrogen applied to sown pastures in the establishment year have increased the grass and decreased the clover content—thereby lowering the later yield of the pasture.

Sulphur.—On the southern tablelands, sulphur deficiency on granite soils has been found to be widespread—along with phosphorus deficiency.

Sulphur deficiency has been found in all 8 soil types of the Clarence Valley.

Potassium.—Calcium and potassium also are in very low supply in Clarence Valley soils. Potassium soil tests have been sought by chemists to determine pastures' need of potassium topdressing. Agronomists throughout the coast and tablelands have co-operated in pasture trials to that end.

On the southern tablelands, potassium has been found clearly deficient in sandstone soils. Responses show that yearly topdressings are needed. On the north coast, annual topdressings with potassium have also been found necessary where heavy cropping has featured in the history. Potassium is especially needed for lucerne production under these conditions.

Minor Elements.—At Tamworth, lucerne has been found to respond to boron.

In all 8 major soils types of the Clarence Valley, molybdenum deficiency has been an important limiting factor. Many other soils on the coast in their natural state have been found deficient in molybdenum.

Moisture Supply/Nutrition Relationships.—On the poor skeletal soils of the southern tablelands, interactions between superphosphate use, depth of placement, and surface or sub-soil moisture, have been shown to be important in pasture establishment and production. These soils have produced equally to good porphyry-derived soils when adequate moisture and deep placement of fertilizer have been provided.

Pasture Establishment Work

Aerial Sowing.—Pasture species have shown varying responses to degrees of seedling cover in experiments to simulate aerial sowing and to determine the factors involved. Grasses established better under some vegetative cover. Legumes were less affected by surface litter. The soil type has proved important. Basalts show more definite responses than sedimentary soils. Granite soils have shown little effect of surface cover, on establishment from surface sowings.

Use of Companion Crops.—Cover cropping establishment-studies at Condobolin showed that the early seasonal conditions after sowing determine the production of the undersown pasture and the survival of pasture plants. Linseed has proven a very suitable cover crop for Jemalong barrel medic; whilst wheat, barley, and oats show decreasing order of compatibility with the undersown pasture plants.

At Condobolin a higher sowing rate for Jemalong barrel medic has been found advantageous when it is sown under a crop.

At Trangie, when lucerne has been undersown to a cover crop the numbers and density of lucerne plants have not been reduced, although yield in early harvests has been affected by crop competition.

At Temora, the long-term effect of cover crops on pasture grazing-yield has been measured in latter years. Results suggest that the sowing rate of subterranean clover can with advantage be increased to 10 lb/acre when sown beneath a cover crop.

Sowing Method.—Experiments have shown the superiority of furrow sowing for the central western plains, although in seasons of good rainfall no advantage has been measured.

At Temora in a time-of-sowing trial, May has been shown to be the best month for sowing pasture species.

Pasture Seed Physiology Work

At Condobolin, sirint rose clover has shown little value as a regenerating annual species, because of high percentage of soft and low percentage of hard seeds.

In Tamworth studies, Woogenellup subterranean clover seed yields of 1,453 lb/acre were obtained. The potential for seed production of pasture species in the northwest is being investigated. Species currently promising for seed production there are white clover, red clover (*Trifolium pratense*), sirato (*Phaseolus atropurpureus*), Leichhardt dolichos (*Dolichos uniflorus*), Bambatsi panic (*Panicum coloratum*) and giant panic (*Panicum antidotale*).

At Temora in a superphosphate rate x stocking rate grazing-trial, major treatment effects in terms of botanical changes in the pasture have been seen. Subterranean clover burr numbers have been lower at higher superphosphate rates and higher stocking rates.

Pasture Management Work

At Tamworth, lucerne has carried 6 sheep/acre for 3 years without additional supplementary feeding.

At Leeton the autumn period is a critical one for annual pastures under irrigation. Forage shortage at that time limits the stocking rate. Summer forage crops have not proved better than summer pastures for filling this feed gap.

At Canberra in winter cereal-grazing experiments, heavy grazing always reduced the grain yield; and the later the grazing, the greater the reduction. On the other hand, lenient grazing increased the grain yields because of the reduction of lodging, disease and frost effects.

On the southern tablelands the feed intake and the faecal output of sheep have been found to be related to the previous treatment of the sheep, and not only to the feed offered during the particular period of grazing. Growth rate of pastures was highest when there was no grazing, lower at 2 weeks exclusion of stock, and increasing again at 4 weeks exclusion. This grazing trial management-phenomenon is being studied further. Mown plots, and a pasture being grazed by 9 sheep/acre, produced similarly over the autumn to summer period.

At Trangie, barley grass content of pastures has been reduced by a high rate of stocking with sheep. A high percentage of barley grass seed heads lowered sheep bodyweights and wool weights.

Native Pastures Work

Near Narrabri, Mitchell grass has produced well in trials. This native species' potential is increasingly appreciated.

At Grafton, native legumes have been promising. Their response to fertilizer phosphorus is of similar order to that of introduced sown legumes.

On the southern tablelands natural pastures' response to nitrogen topdressing has been followed by a depression in later harvests.

PASTURE TRIALS AND DEMONSTRATIONS

Uniform Pasture Survey and Extension Trials (U.P.S.E.T.)

This year 327 U.P.S.E.T. kits were pre-packaged and forwarded to District and Research Agronomists. Of the 327 kits, 142 were fertilizer trials, and the 185 others were species trials. Some new species were included for observation by District Agronomists; Cyfield barrel medic from Western Australia, Cockfoot (GL 36) P9021 from South Australia, and Kangaroo Valley perennial ryegrass selections P9105 and P9106.

District Agronomists have acknowledged the value of U.P.S.E.T., as sources of information for themselves and as focal points for extension demonstrations. U.P.S.E.T. has provided a basis for the local recommendation of pasture species and for diagnois of local fertilizer needs. In particular the trials have indicated: the superiority of Woogenellup subterranean clover; the value and persistance of phalaris, Currie and Brignoles cocksfoots, and of Victorian and Kangaroo Valley perennial ryegrasses; the potential of Sirocco phalaris; the widespread adaptability of Hunter River lucerne; and the supplementary value of Demeter fescue to other winter-growing perennial grasses.

Commonwealth Extension Services Grant Demonstrations (C.E.S.G.)

Twenty pasture demonstrations were established by District Agronomists this year, to demonstrate proven methods to increase pasture production. Success has been promoted by the ready co-operation of farmers in providing land. Of the 20 pasture demonstrations, 9 were on the north coast, nine in the mid-west (Dubbo, Parkes, and Warren), and the 2 others were in the Coonabarabran and Inverell Districts.

Sirocco Phalaris Demonstrations

Sirocco phalaris results have been good in the wheat/sheep and pastoral districts, where rainfall is insufficient for the Australian and Seedmaster cultivars. Sirocco had more vigorous seedling growth than other phalaris cultivars. The established plants grew faster in winter, flowered earlier in spring, and were more dormant in summer. These features have enabled Sirocco to do well where there is a fairly reliable winter-spring growing season of 5 to 6 months but unreliable summer and early autumn rainfall.

For farmer information on Sirocco, demonstrations were set up throughout the 10 in to 12 in April–October rainfall zone. At the associated field days and inspections farmers have shown great interest. This has led to extensive commercial sowings of Sirocco in 1969, despite the ruling high seed prices.

Lucerne Rotational-Grazing Demonstrations

Very successful lucerne rotational-grazing demonstrations have been established throughout the State. One such, 116 acres at Coonabarabran, sub-divided into 8 paddocks, carried 6·3 wethers/acre over an extended period.

Medics Demonstrations in Western New South Wales

Demonstrations using the newer medic varieties have expanded pasture improvement in the low rainfall, central western wheat belt. These annual medic pastures have proven well-suited to the cereal rotation under low rainfall conditions. They have readily established on a wide variety of soil types, and persisted and regenerated under diverse seasonal conditions.

Varieties sown included Jemalong, Cyprus, and Hannaford barrel medics, and Harbinger strand medic. With the current swing back to sown pastures and livestock production, demand has increased for information about adaptability of the newer pasture species and cultivars to soils and climates.

North Coast Demonstrations of Browse-Shrubs

Interest has been shown on the north coast in browse shrubs (such as *Leucaena leucocephala*) sown in conjunction with subtropical pasture mixtures, to increase carrying capacity—particularly on previously uncleared hillsides.

One such demonstration was set up at Upper Crystal Creek, on 5 acres selected on a moderate to steep slope after regrowth and weeds were cleared. The *Leucaena* seed was drilled in rows 6 feet apart at 4 lb/acre. A pasture mixture of 1 lb siratro and 4 lb green panic/acre was sown in December, 1969. By April, 1970, the siratro and green panic had formed a dense cover and the *Leucaena* was about a foot high.

The demonstration has been inspected by beef cattle producers who have become interested in the *Leucaena*/subtropical pasture mixture.

Subtropical Species Demonstrations on the North Coast

These demonstrations included combinations of subtropical legumes and grasses. And to show control of *Amnemus* weevil in tropical pastures, a number of demonstrations incorporated heptachlor (1 lb active ingredient/acre) into the seedbed before sowing.

SOME EXTENSION TRENDS RE PASTURES

Droughts in various Regions have dominated the extension work and have aggravated the stress in farming industries caused by lower wool prices and the introduction of wheat delivery-quotas. Drought also has highlighted lucerne as a pasture species, throughout the State, and sowings have increased in almost every district.

Coastal Trends

In coastal districts, the Ladino white clover seed's high price and failure to show superiority over other varieties have reduced sales of the seed—in favour of Louisiana and Irrigation white clover.

Kangaroo Valley perennial ryegrass has been used more extensively in coastal districts in view of its proven heat tolerance and drought resistance, and also due to reduced seed prices.

Siratro was the most productive and useful subtropical legume on the north coast. It has proved a good hillside legume, versatile in soil adaptability and able to do well even on shallower soils. Also it has shown its compatibility with a wide range of grasses including Rhodes grass (*Chloris gayana*), setaria, paspalum, green panic and guinea grass (*Panicum maximum*).

On sandy and light-textured upland soils *Lotononis bainesii* has given good results.

In north coast farming a swing from dairying to beef cattle raising has been a feature, and subtropical pasture improvement has been directed towards both beef and dairy cattle needs.

On the coast, red clover has been sown in temporary winter pastures to rapidly improve grazing after dry periods.

On the far north coast, kikuyu has been severely affected by yellows disease. There has been some extension of kikuyu yellows in mid north coast districts.

Broadleaf paspalum has been more widely used in mid north coastal areas despite high seed prices.

On the central and south coast, kikuyu continued promising and widely-used, and Kangaroo Valley perennial ryegrass highly regarded for winter pastures. Lucerne also has increased on the south coast. Woogenellup subterranean clover use has widened in coastal areas this year, consistent with a State-wide trend and reflecting its wide adaptability and good seed-production.

Increased use of fertilizer has been noted in coastal districts, particularly superphosphate and nitrogen; potassium also, where deficiency symptoms have been seen on long-cropped paddocks. Lime use has also increased. Molybdenised superphosphate has been widely used in pasture establishment on coastal soils, and copperised superphosphate has been used in the river mouth areas of Kempsey District.

In "problem" areas of the central coast the advantages of *Rhizobium* inoculation and lime pelleting of pasture legume seeds have been more widely appreciated in pasture establishment.

Tablelands Trends

In the tablelands also, changes have included reduced sheep and increased beef cattle numbers. Lucerne, phalaris and Demeter fescue have been increasingly sown. Sirocco phalaris has shown promise in the slopes districts, whilst the "Australian" phalaris cultivar has been most used in the higher and cooler tablelands. Siro 1146 hybrid phalaris has also been very promising (in coastal and tablelands trials) because of its long production season and useful summer contribution. Woogenellup has become the most widely-used subterranean clover. Kangaroo Valley perennial ryegrass and Victorian perennial ryegrass, together with Currie cocksfoots have also been widely used.

As was mentioned for coastal districts, Ladino white clover has been partly replaced by other lower-priced cultivars of white clover.

In the existing economic climate superphosphate use has declined in tablelands districts, concomitant with a decline in pasture sowings.

Prepared seedbeds where applicable for pasture establishment have been more general, because of uncertainty of establishment and slower pasture development from aerial sowing.

Slopes Trends

Lucerne's widespread adaptability as a pasture species in slopes districts has been confirmed.

Geraldton subterranean clover has partly replaced the long-used Dwalganup cultivar in the drier areas. The barrel medic cultivars, Jemalong and Cyprus, together with Harbinger strand medic, have been sown more extensively in the north.

Associated with reduced areas sown to wheat, the percentage of sowings of improved pastures under winter cereal crops has increased in many of the mixed-farming slopes districts. *Phalaris tuberosa* cultivars, including Siro 1146 and new "Select" breeding stocks, have been showing promise in trials.

Increased use of sulphur-rich fertilizers has followed the diagnosis of sulphur deficiencies in the slopes and tablelands soils.

Plains Trends

Lucerne has demonstrated its value throughout the western plains. The barrel medic cultivars Jemalong and Cyprus also have gained a high reputation on the northern and central and been used increasingly on the southern plains along with Harbinger strand medic. Sirocco phalaris has done well with these legumes in some districts. Geraldton subterranean clover has largely replaced Dwalganup. The new "Tornafield" cultivar of *Medicago tornata* has shown some promise on the central plains. Bambatsi panic and green panic, together with buffel grass (*Cenchrus ciliaris*) remain the main improved grass components on the northern plains.

Irrigation Areas Trend

In the irrigation areas, Louisiana white clover is being used in place of Ladino white clover because of lower seed price and reputed less bloat-potency.

Western Division Trend

Cyprus barrel medic has proved promising for extending the western fringe of pasture improvement into the Western Division. For irrigation, and for deep soils, lucerne is still pre-eminent.

PASTURE SEED PRODUCTION

Record Year for Certified Seed

A record 3,640 tons of Certified Seed was produced. Production in the previous year was 1,254 tons. Production of uncertified seed of most species is declining, though substantial quantities of Hunter River Lucerne are still being produced. Favourable seasonal conditions in the south and central west, coupled with farmer interest in alternatives to wheat production, mainly account for the increased Certified Seed production.

Dry conditions towards harvest limited production from perennial species in the central and northwest. Production there came mainly from specialist growers, using irrigation and row-cropping techniques.

Subterranean Clover (Trifolium subterraneum).—Certified Seed of subterranean clover cultivars totalled a record 3,030 tons. Of this, 1,739 tons were of the cultivar Woogenellup—produced mainly in the northern section of the Southern Region. One area of Woogenellup yielded 1,000 lb seed/acre and a number of areas yielded in excess of 800 lb/acre.

Also 788 tons of Mt Barker was produced, despite substantial carry-over from last season.

Production of 22 tons of Yarloop cultivar on heavy self-mulching soils in the Temora district indicated that harvest problems on these soils have been overcome.

Barrel Medic (Medicago truncatula).—Production of Certified Seed of the Jemalong cultivar substantially increased. There were yields up to 500 lb/acre. Seventy tons were produced.

Lucerne (Medicago sativa).—A Certified Lucerne Seed scheme was introduced this year but the season's production is unlikely to exceed 250 tons, even though some 15,000 acres of the Hunter River cultivar were accepted for certification. Many dryland areas were not harvested. Adverse conditions at flowering and/or grasshopper damage were the reasons.

Considerable seed was produced under irrigation but was sold as uncertified seed to meet early market demands.

An area of Cancreep cultivar yielded 110 lb of basic seed. Cancreep production is expected to increase.

Perennial Ryegrass (Lolium perenne).—The season favoured ryegrass seed production and 133 tons of Certified Seed of the Kangaroo Valley cultivar was produced. Seed production of this one has become more of a specialist activity.

Phalaris (Phalaris tuberosa).—Certified Seed production of the N.S.W. cultivar (75 tons) was higher than in the two previous years but notably less than the high levels of five to ten years ago; partly through drought-damage to stands and partly because of large carry-over stocks.

Forty-three tons of Certified Seed of Seedmaster and 15 tons of Sirocco were produced. Considerable interest has been shown in Sirocco seed production, particularly in the northwest and increased production is expected. Sirocco's height and tendency to shed seed present harvest problems, so yields are low and the price high.

Tall Fescue (Festuca arundinacea).—Production of Certified Seed of Demeter fescue reached 82 tons; twice the previous year's.

Cocksfoot (Dactylis glomerata).—Five tons of Certified Seed of Currie and one ton of Brignoles were produced. Production of Cocksfoot seed is declining, partly because of drought effects and partly because of difficulties in reaching acceptable quality.

Broadleaf Paspalum (Paspalum wettsteinii).—Growers have had difficulties in producing seed of this species. Only 3 tons of Certified Seed was produced.

Improved Certification Procedure

Changes made to expedite the handling of seed included: the elimination of insert slips at final sealing; precleaning issue of labels to seed cleaners for sewing on to bags; allocation of laboratory sample numbers by regional offices; and (to reduce the total of seed lots) the blending, where possible, of standard-grade seed-lots to a maximum of 220 bags.

Interest in bulk handling of seed is now notable but bulk-handling of Certified Seed is handicapped by the lack of suitable holding facilities at many cleaning centres.

N.S.W. Herbage Plant Liaison Committee

This Committee includes representatives of merchants and seed producers as well as the seed-introduction and breeder organisations. It continued a significant role in the registration, release and seed multiplication of new cultivars of herbage plants. This year it recommended registration of two cultivars of Caucasian clover (*Trifolium ambiguum*) and two of rape (*Brassica rapus*), and approved the release for commercial use of "Celera" mung bean (*Vigna radiata*) and "Whittet" kikuyu (*Pennisetum clandestinum*).

The Department has adopted the Committee recommendation that it certify seed of all cultivars released by the Committee, to the basic seed level.

In response to recommendations from Herbage Plant Liaison Committees of the various States, the Australian Agricultural Council has approved the establishment of a National Co-ordinating Committee for Seed Certification. The latter will co-ordinate the maintenance of genotype and the production of basic seed of herbage plant cultivars throughout Australia. It will also attend to matters related to the Seed Certification Scheme of the Organisation for Economic Co-operation and Development (O.E.C.D.); a Scheme that Australia is seeking to enter. The Seed Certification Schemes conducted by the various States, including N.S.W., were inspected in January/February, 1970 by Mr J. Butler, Chairman, O.E.C.D. Advisory Group.

Commercial Organizations in the Seed Industry

Excellent co-operation and liaison continued with the N.S.W. Seedgrowers' Association, N.S.W. Seedmen's Association, the Seed Industry Association of Australia and the N.S.W. Seed Increase Committee. The Department has adopted the N.S.W. Seed Increase Committee recommendation that Certified Seed produced under a pedigree system be restricted to areas sown to basic seed. The restriction will take effect in the 1970–71 season.

Seed Marketing

Because of the record seed-harvest, particularly of subterranean clover, and significant carry-over of several cultivars from the previous season, the home market for herbage seeds is over-supplied at present. Consequently the price of seed of many cultivars has dropped, and a large carry-over of seed stocks is likely.

Efforts have been made to locate acceptable overseas markets, but local merchants have no significant export orders in hand for pasture seed.

Seed Import Statistics

More than 1,770 tons of seed entered Australia through New South Wales ports in the 12 months to 31st December, 1969. The main components were ryegrass, white clover and red clover from New Zealand. Considerable grass seed for lawn sowings was also imported.

Seed Production Research

Current research by Tamworth Agricultural Research Station indicates several herbage species suiting seed production under irrigation in the northwest. These include white clover, red clover, and several subtropical legume and grass species.

Seed Certification Inspection Statistics

Eight Seed Production Officers, located at the main seed-producing centres, and District Agronomists inspected 66,600 acres and paddock-sealed 81,317 sacks comprising 887 seed-lots.

Inspections under the Various Acts

Three Inspectors continued field inspections throughout the State under the Agricultural Seeds Act, Stock Foods and Medicines Act, Pest Destroyers Act, Fertilizers Act and Veterinary Surgeons Act. They visited 78 towns and suburbs, made routine inspections of 343 stores and 151 special visits, and in these activities took 101 samples.

Unregistered products detected included 242 stock medicines, 51 stock foods, 28 pest destroyers and 4 fertilizers. Warnings were issued to the marketers of unregistered products in New South Wales.

These Inspectors were also part-time on Seed Certification work. They did the final sealing of all Certified Seed cleaned in Sydney.

Agricultural Seeds Act Regulations Amended

Regulations under the Act were amended this year to specify Indian hemp (*Cannabis sativa*) as prohibited.

Major revision of the Agricultural Seeds Act and Regulations to establish conformity with other States is continuing.

THE SEED TESTING LABORATORY STATISTICS

The Laboratory started the year with 2 and ended the year with 6 of its 19 established technical positions vacant. There were 9 resignations and 5 appointments, and an accumulated loss of 278 man-work weeks due to longstanding vacancies and recruitment problems.

There was a 10 per cent decrease in the number of samples received but a large carryover of work from the previous year. Of the 2,854 samples received, 425 were examined for the Commonwealth Quarantine Authorities—23 per cent less than in the previous year. Some 900 samples of Certified Seed of pasture species were tested; almost doubling each of the immediate 2 preceding years. In the total were 82 lucerne samples—from the new Lucerne Seed Certification Scheme.

Samples under the Maize, Sorghum and Bean Seed Certification Schemes, involving the more specialized seed grower, decreased from 530 samples in 1968–69 to 450 samples. Of the remaining samples: 293 were tested for the cotton and rice industries; 441 were submitted by Departmental officers; 240 samples represented uncertified seed intended for sale; 93 samples comprised seeds for identification; and 13 were of regulatory origin.

Four Seed Collections were received, from 3 countries. These approximated 1,400 authenticated seed type samples and will be in the Laboratory's Reference Seed Collection.

Tests and technical assistance were provided to seed firms, farmers, members of the public, the Police and Railways Departments, Soil Conservation Service and the Department of Customs and Excise.

Fodder Conservation

GRAINS

Feed-grain production was an overall record. This, coupled with the "above-quota wheat" stored on farms, has resulted in higher-than-ever grain reserves for stock feeding.

Oats.—The 36 million bushels of oats produced (second from largest crop on record), together with large stocks held on farms, caused generally low prices (35 to 45 cents/bushel; some sales as low as 18 cents). This led to reduced prices for all other feed grains.

Barley.—Barley production, 15 million bushels, almost 4 million above the previous year's, was a record. Feed-barley prices were 44 to 48 cents/bushel on the farm. Thus this grain was better value for stock feed than was oats at 35 to 45 cents.

Maize.—Whereas the 1968–69 maize grain production was 2·25 million bushels and well above former levels, the 1969–70 harvest is expected to be about 5 million bushels. The bulk price of maize to farmers has been low, ranging from 77 cents to 93 cents/bushel.

Sorghum.—The 1969–70 sorghum harvest, about 8 million bushels, was a big increase on the previous year's 2·7 million. These 2 harvests, with the effects of supplies of the other grains, have created a grain surplus. Thus, prices were $21 to $23 a ton for most of this year, but have improved to $28 on the farm.

Wheat.—An appreciable quantity of "over-quota wheat" is reported to have been illegally traded (i.e., outside the Australian Wheat Board control) and is thought to have led to reduced prices for other feed grains. Surplus wheat, and the other grains, have overtaxed the farm storages. The mice plague and weather damage have caused loss of some stored grain.

HAY

Production and stocks of hay to 31st March, 1969, aggregated 1,820,000 tons; the second from highest reserve on record and exceeded only by the 1967 reserve of 1,888,000 ton. The 1969–70 hay production has been estimated at 1·9 million ton. Growth conditions up to December, 1969, were good, but rain badly damaged the hay crop before baling. In some areas it was too wet to make hay.

Oaten Hay.—Many areas of oats sown for grazing were allowed to mature for hay or grain. By estimate, some 260,000 tons of hay were made. Price has varied from $8 to $30 a ton. Until recently the demand has been very limited, due in part to the season and the preference by sheepmen for grain.

Wheaten Hay.—Wheaten hay production estimated at 185,000 ton would be the highest since 1953–54. Prices asked early in the season varied from $14 to $28 a ton. Few sales were made, even at the lower price.

The mice plague has seriously damaged wheat and oaten hay stacks, more so where sheaf hay has been stacked—the grain having been eaten out of the heads and much of the hay fouled.

Lucerne Hay.—Sowing of lucerne as a pasture having continued at an increasing rate for years, increased quantities of lucerne hay have been made in almost every recent year. In the past year the production would be the second from highest on record; estimated at 550,000 ton. More could have been made but for wet weather. Lucerne affected by wet periods was not entirely lost; much of it was silaged.

The quality of lucerne hay varied widely; also the price—ranging from $15 to $40 a ton.

A trend towards use of the higher quality lucerne and pasture hays as a roughage for cattle is developing, especially in the rapid expansion of beef cattle industry. Numerous enquiries from specialist lucerne growers have concerned lucerne hay contract-production. It could be developed into a large coastal-market.

Two more lucerne pelletting mills were established in 1969–70.

Pasture Hay.—Production for 1969–70 has been estimated as 460,000 tons; third from highest on record. Considerable areas of pasture intended for hay were made into silage due to wet conditions. Prices ranged from $12 to $35 a ton.

SILAGE

Silage production in 1969–70 has been estimated at 420,000 tons; as against the 1962–63 record 603,000 tons. Native grasses, green oats, frosted wheat and weeds of all descriptions were used.

One western Riverina grazier laid down 10,000 tons of surplus paddock-feed in pits, at a little over 60 cents a ton to harvest, dig the pits, and store. Others ensiled up to 8,000 ton, at $1 a ton; about 0·4 cent/food unit. This is well below the 3·5 cents/food unit for wheat at $1.50/bushel.

GENERAL

The Fodder Reserves Situation

The estimated total of fodder produced and that held on farms in the past year would be enough to provide for about 7½ weeks at maintenance ration for all sheep equivalents in New South Wales; an improvement, by a little over 1 week's reserve, on the situation a year ago. A reserve sufficient for 12 weeks would be desirable.

Over the past 5 years the reserves-situation has varied extremely: in 1965, enough for 5 weeks; in 1966, for 4 weeks; in 1967, for 8 weeks; in 1968, for 4 weeks; in 1969, for 6 weeks; and in 1970 (estimated), for 7½ weeks.

Utilization of Stored Fodders

The notable increase in beef cattle numbers has increased the enquiries about fodders and cattle-feeding. Use of grain as a stock feed has been encouraged by the big reserves of all grains, including "over-quota wheat", the lack of an established market, and the general low prices. Grain use, especially in central and north coast dairy farming, increased considerably.

Interest in fodders for modified feedlots or to finish cattle initially raised on pastures is increasing.

The Grain Farm-Storage Problem

The 1970 large feed-grain harvest plus the 14 million bushels of "over-quota" and seed wheat, has made a storage problem on almost all grain-producing farms. Many grain sheds, galvanized iron silos, temporary weldmesh silos, pit silos, bags and open dumps have been used. Losses before the grain is finally utilized are certain.

Research on High-Moisture Grain Storage

Small trials at the Glen Innes and Grafton Agricultural Research Stations indicate that maize with high moisture content (20 to 27 per cent) may be safely stored under airtight conditions. After 8 months storage the grain was in excellent condition. It had gone through a mild ferment. It was readily eaten by dairy cattle and pigs.

Increased Grain-Drying

Grain-drying continued to expand. Now there are few grain-producing areas of the State that do not have driers.

Officers' Fodder Conservation "Workshops"

Workshops to discuss fodder conservation were launched in the preceding year and the system was continued in the first quarter of 1969–70. Meetings of Regional staffs were held at Maitland, Cowra, Lismore, Tamworth, Gunnedah, Wagga and Leeton.

Irrigation

EXPANSION

Rapid expansion of irrigation continues. Most expansion is in the Macquarie Valley. Reduced returns from wheat and wool have accentuated interest in irrigation for possible diversification of cropping which, in some areas, has occurred at the expense of irrigated pasture area. Intensive row-crop production necessitating efficient water-management has brought greater awareness of need of thorough land-preparation.

IRRIGATION RESEARCH

A Research Agronomist (Irrigation) completed training at the CSIRO Irrigation Research Station, Griffith and took up full-time duties at Leeton Agricultural Research Station.

For the past 2 years he has been involved in research into crop-density, and water-use with irrigated maize on sodic clay soils. The results, enabling timely information on water management, have important wide application, because of the expanding irrigated maize-production in New South Wales.

These conclusions and recommendations have arisen from the maize research:

(a) *Visual Assessment of Relative Turgidity.*—Using a reference set of photographic standards, it has proved possible to assess the relative turgidity of maize leaves. It is now practicable to place a quantitative measurement on the water status of a crop. The method will be used as an irrigation guide for farmers.

(b) *A Water-yield Production Function for Maize.*—A physiological-based water-yield function production for maize has been developed. Knowing the water available and the time it is available, the yield of maize may be predicted. This hitherto unavailable information is needed by economists and irrigation planners.

(c) *Water-stress at Female Meiosis in Maize.*—A short, severe water-stress at female meiosis in maize has been shown to so delay or prevent silk-emergence that pollen-shedding ends before silks emerge. Studies of the cytology of the developing embryosacs, in association with a CSIRO officer, suggest that water-stress causes hormone-induced changes in the embryosacs. These delay silk-emergence.

TRICKLE IRRIGATION

Trickle irrigation has greatest application where water supplies are restricted or highly priced. Overseas research and practice suggest that through a more even watering-regime it increases the yield of many crops. Current research by the Victorian Department of Agriculture at Scoresby Research Station, and New South Wales central coast experience with various trickle systems, indicate potential for the method in Australia.

Adaptability of various trickle systems to New South Wales conditions is being investigated by the New South Wales Department. This research will provide data on resultant growth rate, production and quality of horticultural crops; besides the in-practice matters of labour needs, economic water-use and design, outlet-spacings, variations in water-quantity applied, discharge rates, and fertilizer-application in the water.

As a training-project at the CSIRO Division of Irrigation Research, Griffith, a second Research Agronomist (Irrigation) of the Department is comparing furrow, spray, trickle, and sub-irrigation in relation to tomato prodiction.

FARM WATER SUPPLIES ACT MATTERS

Rate of applications by landholders, for advances of more than $4,000 under the Farm Water Supplies Act to purchase and instal pumping plants and other equipment, has declined. This year there were 96 applications, as against 130 in 1968–69. Most District Agronomists were involved again this year in processing the applications.

Cloud Seeding

PREVIOUS OPERATIONAL CHARACTER

The New South Wales Department of Agriculture has been operating cloud seeding aircraft since May, 1965. Until 31st October, 1969, it was basically a drought-relief operation. The aircraft were based at various country airports, according to seasonal changes and the priorities of drought-stricken areas. Throughout those 4 years (almost), most of the State was drought-declared at one or another time and the *ad hoc* activities meant that no one particular area was so consistently seeded as to enable analyses of results.

CURRENT EXPERIMENTAL PROJECT

On 1st November, 1969, the Department started an experimental project to provide data on the effectiveness of cloud seeding over western New South Wales, hoping to provide concurrent economic benefit. The project is attempting to compare the rainfall measured in a "target or seeded area" with that in two adjacent "non-seeded control areas)); and also to compare the rainfall recorded in the target area, for the 3 years of the experiment, with the previous 40 years' recorded rainfall.

Assessment of the effect of cloud seeding on rainfall downwind of the target area may also be possible. If rainfall is shown to have been increased in the downwind area, the known economic returns from cloud seeding would be increased—provided the rains were at the right time.

The target area lies between: the 30° S. parallel (about 5 miles north of Bourke) and the 32° S. parallel (about 30 miles south of Cobar); the western boundary is 144° 30′ E. meridian (about 5 miles east of Tilpa) whilst the eastern boundary is 147° E. meridian (about 10 miles west of Nyngan). The area comprises about 20,275 square miles.

The two control areas have been selected to provide the best possible comparison with the target area. One lies due north of the target area and the other to the southwest. Their location has been so chosen in hope of avoiding downwind effect and upwind bias. Most rain-bearing systems appear to move through this part of the State from north to south or from northwest to southeast.

The project should permit evaluation of cloud-seeding influence on the rainfall over northwestern areas of New South Wales and downwind of the target area. Should results be favourable they could apply to a big area of the State.

Weeds Work

ACTIVITIES OF THE NOXIOUS PLANTS ADVISORY COMMITTEE

The Noxious Plants Advisory Committee continued effectively to co-ordinate noxious plant matters between the Departments of Agriculture,Local Government and Lands, and Local Government bodies. The Principal Agronomist (Weeds) is Chairman.

A $450,000 grant was made by the Government of New South Wales to aid Local Government Councils' noxious plant control programmes; $50,000 more than in the previous year. $20,000 of the extra was used to establish the Far North Western Slopes County Council; the other $30,000 supplemented the normal $400,000. Despite the increase, requests for financial aid considerably exceeded the grant.

Allocations to councils were $ for $, on the established principle, except that for the Western Division they were on a $2 for $1 basis. Special grants (no matching-funds contribution is required for 'special grants') were allocated to treat infested vacant Crown lands and to purchase specialized equipment.

Interstate common-interest meetings were held at Mildura and Broken Hill, with officers from the Victorian Department of Crown Lands and Survey and the South Australian Department of Agriculture. At the Broken Hill conference, mesquite (*Prospis juliflora*) encroachment on the South Australian border was discussed and Broken Hill Mesquite Destruction Committee was formed. The infestations have been mapped. Steps to eradicate the danger are being taken.

Disappointingly, expansion of responsibilities of the Far North Coast County Council to effect an "all weeds" county council has not been finalized.

The Noxious Plants Lists for the State are being revised, for each Agricultural Region. The revision should be completed within 2 years. The South Western Region's list has been reviewed.

WEEDS EDUCATION AND EXTENSION ACTIVITIES

In association with the Noxious Plants Advisory Committee, the Department conducted a school for Councils' Weeds Officers, at Hawkesbury Agricultural College. The object was to bring them up to date with recommendations and enhance the efficient conduct of their programmes.

A correspondence Certificate Course of Instruction ("Weed Control Practices") has been listed in the Department of Technical Education's Handbook for 1970. Assuming sufficient enrolments, the course will start in 1971.

A "Thistle Symposium" organized by the South Coast and Tablelands agricultural regional extension services in association with the New South Wales Weeds Society was well attended.

Well-received weeds displays were staged this year at agricultural shows at several country centres.

WEEDS INSPECTIONS AND INVESTIGATIONS

Field Officers (Weeds) conducted a number of surveys, enabling reports on: Noxious plant control in the Hunter Valley; Cotton bush (*Asclepias physocarpa*) at Nymboida; Blue heliotrope (*Heliotropium amplexicaule*) at Merriwa; and Indian Hemp (*Cannabis sativa*) at Bellingen, Kempsey, and in the Hunter River Valley. These officers also did the survey of mesquite infestations at Broken Hill.

Collection of burrs and specimens of *Xanthium spp*. has revealed predominance of Cockle burr (*X. italicum*) in many areas. This collection was made to supply samples for an ecological analysis of *Xanthium spp*. by Professor Calvin McMillan of Texas University, Austin, U.S.A.

SOME PARTICULAR WEED MATTERS

Galvanised Burr (Bassia birchii).—The Australian Wool Board has allocated funds to establish a post-graduate training position for a Research Agronomist (Weeds) to study the autecology.

Paterson's Curse (Echium lycopsis).—Liaison with the Agricultural Research Institute, Wagga, has led to the start of a research project aimed at control.

Grass Weeds and Other Weeds of Pastures.—With support from Australian Wool Board funds, provision of a post-graduate (training) position in weeds research at the University of New England has been approved, based on a programme aimed at evaluating their importance.

Biological Control for Groundsel Bush (Baccharis halimifolia) *and Lantana* (Lantana camara).—Biological control agents are showing promise. They have been tested by the CSIRO, and by the Queensland Department of Lands. It is too soon for firm conclusions on lantana control, but a tingid bug *Leptobrsa sp.* and longicorn beetle *Plagiohammus spp.* are attacking some lantana areas of Queensland and New South Wales. The New South Wales Forestry Commission has been concerned with large-scale field release of insects likely to control lantana.

Thistles.—Large areas in the southern, central, and the northern tablelands are infested by *Silybum marianum, Cirsium spp. Carthamus spp. Onopordum spp. Carduus nutans* and *Centaurea spp.* Improved management combined with selected herbicide treatments has helped to reduce the thistle menace.

The Weed Grasses.—Wild oats (*Avena fatua* and *A. ludoviciana*), Wimmera ryegrass (*Lolium rigidum*), *Phalaris paradoxa* and spear grasses (*Stipa spp.* and *Aristida spp.*), barley grass (*Hordeum leporinum*), African love grass (*Eragrostis curvula*) and long-styled feather grass (*Pennisetum macrourum*) are causing concern on agricultural and pastoral lands. Barnyard grasses (*Echinochloa spp.*) are still the most important weeds of irrigated crops such as rice and cotton, but satisfactory control with herbicides is available.

The Broad-leaved Weeds.—Skeleton weed (*Chondrilla juncea*), mint weed (*Salvia reflexa*), black bindweed (*Polygonum convolvulus*), spiny emex (*Emex australis*), fumitory (*Fumaria spp.*), soursob (*Oxalis pes-caprae*), silver-leaf nightshade (*Solanum elaeagnifolium*), sheep sorrel (*Acetosella vulgaris*), noogoora and Bathurst burrs (*Xanthium spp.*), horehound (*Marrubium vulgare*), devil's claw (*Martynia spp.*) and khaki-weed (*Alternanthera echinata*) are causing difficulties in various situations—including crops, roadsides, and pastoral lands. Darling and black peas (*Swainsona spp.*) have caused some severe stock losses in western areas.

St John's Wort (Hypercium perforatum).—This is being checked by a Chrysomelid beetle. Arrangements have been made by various councils to disseminate the beetle. But the weed is most effectively controlled through establishment of improved pastures.

Woody Weeds.—In western areas these are causing an economic problem where the control has to be evaluated relative to the landowner's resources. Species causing concern are seedlings of cypress pines (*Callitris spp.*), bimble box (*Eucalyptus populnea*), budda (*Eremophila mitchellii*), turpentine bush (*Eremophila sturtii*), punty (*Cassia eremophilia*) and hopbush (*Dodonaea viscosa*).

An Aquatic Weed (Salvinia auriculata).—This menace has been found widespread in coastal areas.

WEEDS RESEARCH

Research Positions

The number of weeds research positions increased to 9 through provision of 2 in-training positions, but each of the latter is still vacant.

The Weeds Research Agronomist from Bathurst Agricultural Research Station continued on study leave at the University of New England but also supervised a limited research programme at Bathurst.

The Research Agronomist (Total Vegetation Control), at Hawkesbury Agricultural College resigned. This position and that of Research Agronomist (Adaptive Weed Research), also located at Hawkesbury College, have been filled. The research position dealing with row-crop weed control was transferred from Hawkesbury Agricultural College to Tamworth Agricultural Research Station, to expand weeds research into irrigated row-crops in the north west.

Irrigated-Crop Research, in the M.I.A.

Work on weed control in rice crops involved two main factors: (i) Trials indicated that 0·5 lb atrazine/acre in the soil could reduce rice stands but higher rates would be needed to significantly reduce yields. (ii) Molinate proved superior to several new herbicides tested.

Some research was done on weed problems in selected vegetable crops; also on control of water weeds, in association with the N.S.W. Water Conservation and Irrigation Commission.

Weeds Research at and from Hawkesbury Agricultural College

Total Vegetation Control.—Work was limited by the resignation of one officer; and recruitment of a replacement in December, 1969.

Weeds in Vegetables.—Trials were started at Hawkesbury College. Trials concerned with weeds in potato crops were serviced at Orange Agricultural Research Station.

Adaptive Weed Research.—In this project, cost-efficiency of galvanized burr spraying is being clarified.

Weeds Research, Wollongbar Agricultural Research Station

Work on the ecology of crofton weed and other woody weeds of the north coast has been completed. The research officer has been awarded a M.Sc.Agr. by the University of Sydney for his thesis drawn from the project. The important conclusions are: Crofton weed is the major weed problem of the Richmond-Tweed area; Groundsel bush is the greatest potential weed problem of the north coast; Biological control of crofton weed has had only limited success; If satisfactory pasture species are available they, and cultivation, are the best means of crofton weed control; 2, 4-D and 2, 4, 5-T applied in late autumn and summer are less costly than the present treatment to control crofton weed.

Weeds Research, Bathurst Agricultural Research Station

The research officer on study leave at the University of New England has supervised several trials, with these results: Comparison of different forms of 2,2-DPA demonstrated no significant difference in effectiveness between the sodium salt (presently used) and an ester form; mixtures of herbicides (to suppress native species) were superior to single herbicides; and lucerne's establishment was enhanced more than subterranean clover's by this means.

Weeds Research, Tamworth Agricultural Research Station

Wild Oats Research.—The trials on competition between wild oats and wheat are producing useful information.

In spray-pattern work, correct choice of volume/acre, and nozzle design and placement, have been shown to increase significantly the amount of spray hitting a wild oat plant.

Irrigated Row-Crop Weeds Project.—The research position was filled as recently as January, 1970. The agronomist has been surveying/assessing the problems needing research.

Weed Research at Other Centres

Temora.—Weeds control research was not continued at Temora Agricultural Research Station but the research agronomist there has prepared papers on broomrape and barley grass in lucerne for publication.

Glen Innes/Tenterfield.—The Glen Innes District Agronomist undertook a limited research programme on control of *Eragrostis* sp. He also assisted a survey of the problem undertaken by the Weeds Research Agronomist from Wollongbar Agricultural Research Station.

Narrabri.—A trial at Narrabri Agricultural Research Station, to assess the effect (on subsequent grain crops) of soil residues of herbicides used in cotton, produced useful data.

Other Stations.—Weed control at other Research Stations was done by officers of the Division of Horticulture. Division of Plant Industry officers provided advice where needed.

REGISTRATION OF HERBICIDES

The several new chemicals registered as herbicides under the Pest Destroyers' Act included: methabenzthiazuron; cacodylic acid; some more organic arsenicals; chloroxuron; and metabromuron. Several other products were examined and recommendations were made as to their herbicidal potential.

DIVISION OF HORTICULTURE

General

STAFF

Administrative Staff

Mr R. G. Kebby, Chief of the Division of Horiculture, retired in June, 1970, after 45 years' service with the Department. Mr G. R. Gregory, formerly Deputy Chief, was appointed as Chief of the Division to succeed Mr Kebby. Mr J. K. Long, formerly Principal Fruit Officer (Research), was appointed as Deputy Chief.

A new position, Assistant Principal Fruit Officer (Citrus), was created by reclassification of an existing position and Mr J. H. Duncan appointed to the new position. Creation of another new position, Assistant Principal Fruit Officer (Regulatory), has also been approved.

Research Staff

As was so 12 months earlier, there are three vacant Fruit Officer (Research) positions. One position had been filled by a Departmental trainee on completion of studies towards a Ph.D., but the effect was negated by resignation of another officer in December, 1969. The vacant positions are at Bathurst Agricultural Research Station, Yanco Agricultural College and Research Station, and Dareton Horticultural Research Station.

One research officer has completed Ph.D. studies. Five others are studying for a Master degree, as external post-graduate students. Another was awarded a Public Service Board Fellowship and a grant from the Australian Wine Board, enabling him to spend 6 months in Israel investigating trickle irrigation.

Extension Staff

The year started with the Division at full strength in the extension establishment, but three experienced District Fruit Officers have resigned, two officers-in-training have transferred to other positions, five officers have been recruited for training, and there are two new positions; the net effect was two vacancies at the close of the year.

The more disturbing picture is that 5 of the 21 Fruit Officer Districts are vacant, only four of the 21 Districts are currently staffed by senior officers and two of the four officers are also part-time in an adjacent vacant District, three Districts are serviced by Grade 2 officers one of whom is also attending to two adjacent Districts. Nine of the 21 Districts are served by young Grade 1 officers, two of whom are attending also to adjacent Districts.

Whilst experienced extension officers are scarce, the number of students at the Hawkesbury and the Wagga Agricultural College interested in the Division of Horticulture as a career is increasing. Because of this and the decision to appoint College trainees direct to the Division at the time of their recruitment as student-trainees, Division of Horticulture intakes of graduating trainees at the end of 1970 and the end of 1971 are assured. Thirteen young Officers are now in training; four who were appointed in 1968, 6 in 1969 and 3 in 1970.

Regulatory Staff

Despite repeated efforts to recruit staff, there has not been a full complement of regulatory staff at any time this year. This shortage, coupled with expanding work load, caused considerable difficulty in maintaining essential services.

Resignations, retirements, etc., included the Officer-in-Charge, Plant Quarantine Station, 3 Inspectors (Plant Diseases Act) and 3 Regulatory Assistants. New appointments were an Officer-in-Charge, Plant Quarantine Station, 10 Inspectors (Plant Diseases Act) and 3 Regulatory Assistants. Four Inspectors were promoted to Supervising Inspectors, and 2 Regulatory Assistants were appointed as Inspectors. Positions created included 7 for Inspectors at Export and Import Branch and 1 at Port Kembla.

Vacancies at 30-6-70 were for 8 Inspectors and 2 Regulatory Assistants, a total of 3 more than at 30-6-69.

Divisional Conference

More than 100 research, regulatory and extension officers attended the Division of Horticulture Conference at Hawkesbury Agricultural College in May, 1970. Apart from addresses and symposia conducted by Divisional personnel and other officers of the Department, Conference was addressed by the Chairman of the Sydney Farm Produce Market Authority, the Chairman of Directors of the Banana Growers Federation Co-operative, a representative of the N.S.W. Lemon Marketing Board, the General Manager of the Shepparton Preserving Co. Ltd, the Chief Fruit Officer (Exports) of the Commonwealth Department of Primary Industry, the General Manager of Penfolds Wines Pty Ltd, and a representative of the Victorian Department of Agriculture.

Overseas Visits and Studies

Mr R. E. Smart, Fruit Officer (Research) at the Griffith Viticultural Research Station, was awarded a Public Service Board Fellowship and a grant from the Australian Wine Board. These awards have enabled him to attend and present papers to the XVIIIth International Horticultural Congress in Israel and to spend 6 months in that country at the Volcani Institute of Agricultural Research; to study and do research into various aspects of horticultural irrigation—especially the "trickle" method. He will spend three weeks in grape areas of Europe and U.S.A. whilst returning to Australia.

Mr J. W. Turpin, Principal Fruit Officer (Citrus), also attended the International Congress in Israel, and presented a paper on "Citrus Improvement in New South Wales". His paper provoked considerable interest, particularly concerning use of dwarfing bud-lines to control tree size and permit more trees per acre. This State's lead in this field was also acknowledged during Mr Turpin's subsequent study tour of citrus culture in Japan, Israel, Italy and the U.S.A. His studies in these countries concentrated on improvements in cultural methods, mechanization of harvesting, spacing and hedging of trees, herbicide management, and improvement of varieties and rootstocks.

Attendance at Australian Conferences, etc.

Fruit Officers (Research), Mr D. W. Turner of the Alstonville Tropical Fruit Research Station, and Mr R. E. Smart of the Griffith Viticultural Research Station, attended the 41st ANZAAS Congress in Adelaide. Mr Turner presented a paper on "New Developments in the Production of Tropical Fruits". Mr Smart spoke on "Irrigation and Wine Quality".

Five Divisional officers attended a Plant Physiology Refresher Course at the University of Sydney farm, Camden; a Course organized by the New South Wales Branch of the Australian Institute of Agricultural Science. The seminars included lectures, demonstrations and tutorials by staff of the Macquarie University School of Biological Sciences and the University of Sydney Faculty of Agriculture.

Officers also attended in Brisbane a conference of technical officers engaged in post-harvest banana research. The attendance included research staff from the CSIRO and the Queensland Department of Primary Industries. The mixed-ripe problem, ripening, transport in polyethylene bags, packaging, disease control and pre-cooling were among the subjects.

AUTOMATIC DATA PROCESSING APPLIED TO THE FRUIT TREE CENSUS

Collection and compilation of fruit tree planting statistics were suspended in 1965 because of continuing staff shortage and the time-consuming nature of this work. To alleviate the problems of collation and publication, automatic data processing was applied during the past year. New orchard-record cards were introduced, and means to acquire additional information about management practices was included.

Notwithstanding the immense amount of work involved through introduction of the new and more comprehensive system, the success was such that the initial deadline (May, 1970) for availability of basic data was met. The figures this year do not include the current ones for the M.I.A. and north coast but the achieved results have been outstanding. The whole of the State is expected to be covered by the 1970–71 census.

Further, co-operative action has been taken with the Department of Lands towards aerial photographing of all fruit growing areas in the State; to assist field officers to check the accuracy of their records. With use of automatic data processing and access to aerial photographs, the accuracy of the Department's fruit tree planting records should equal any throughout the world.

Research for the Fruit Industries

RESEARCH—POME FRUIT INDUSTRIES

Apple Rootstock Trials

These are to evaluate performance of a number of stocks; mostly woolly aphid resistant clonal selections of the Malling Merton series and the semi dwarfing Northern Spy. The scion varieties are Delicious, Jonathan, and Granny Smith. The main trials, now some 10 years old, are at the Bathurst, Glen Innes, and Yanco Research Stations, and in the Orange district.

Definite conclusions cannot be drawn until 5 or more years hence, but several stocks are showing considerable promise for production of semi-dwarf types trees. In this regard MM110 is possibly the best when all aspects are considered. Whilst MM106 is performing equally well, trees produced by it are a little more vigorous. For the Granny Smith variety, none of the stocks appears to be significantly better than Northern Spy.

Controlled Atmosphere (C.A.) Storage—Use of Plastic Tents

Controlled atmosphere (C.A.) storage of apples has in recent years become an established practice in Australia, with resultant big improvement in fruit offered for sale late in the season. High premiums have been paid for such fruit.

Conversion to C.A. System.—A number of existing apple storages were converted to C.A. at considerable expense but the method used is likely to have limited the life of some of the buildings, because of water accumulation in the insulation.

In association with the Agricultural Engineering Section of the Department's Division of Research Stations, a project to produce an inexpensive but efficient C.A. store by conversion of smaller cool stores has been continued. The 1,500 bushel plastic-room, open flame generator, and lime scrubber, installed in 1969 in the store of a commercial orchardist have operated successfully. The room was opened several times over a long period to allow marketing of the fruit. After each opening, the generator was used to readjust the atmosphere. It is now apparent that even small cool-store operators could afford to convert to C.A. by this system.

A field day was held to show the progress made and there was strong grower-interest in expanding the investigation to cover larger installations. As a result 10 cool stores were converted to the system this year. The system is likely to be widely adopted in New South Wales for converting older cool rooms to C.A. storage. There is also a lot of interstate interest. One unit is already installed in Victoria.

Capital cost of converting a 5,000–6,000 bushel cool room is about $2,500; including plastic room, generator, scrubber, remote thermometers, and gas analysis equipment. Allowing for depreciation, interest on investment and maintenance, an extra cost of 25 cents per bushel of storage space is suggested as a guide to operating costs. Premia for C.A. stored fruit have generally exceeded $1/bushel.

Storage at Ambient Temperatures.—In view of the success of banana storage research using sealed plastic bags to obtain favourable atmospheres at ambient temperatures, studies with other fruits have started. Granny Smith apples are being stored under C.A. at ambient temperatures at Bathurst Research Station and at higher temperatures at the Ryde laboratories, using the plastic room concept. The purpose is to develop an inexpensive method for short-term storage of apples for the winter market; high quality apples in particular. Other preliminary studies suggest that this method may have wide application for short-term storage of pears.

Effect of Growth Regulator on Fruit Maturity and Quality

At Bathurst Agricultural Research Station, one spray application of the growth regulator alar, applied 45 to 60 days before harvest, improved the colour of Delicious apples and, to a lesser extent, Jonathans. No significant difference was observed between sprays applied 45, 52, or 60 days before harvest. Rates of 4 lb and 6 lb/acre on Delicious were effective, with the 6 lb rate slightly the better. The sprays improved the colour of fruit produced inside the canopy of the tree. Such fruit is often green and difficult to colour.

Breakdown in Apples

Data from studies in New Zealand in 1968 by an officer of the Division have been analysed. Incidence of the physiological disorder "breakdown" was reduced as weight-loss increased. This confirmed previous results in Australia from co-operative trials with the CSIRO Division of Food Preservation at North Ryde.

In the New Zealand study, using fruit from a fertilizer field-trial, increasing the weight-loss reduced breakdown irrespective of fertilizer application, but effects of fertilizer on breakdown were not explained by weight-loss differences.

Levels of acetic acid in the fruit after storage appeared to be positively correlated with fertilizer effects. Nitrogen applications resulted in highest breakdown and highest acetic acid. Trees receiving phosphorus produced only fruit with low incidence of breakdown and low level of acetic acid. This is a major finding towards explaining the roles of nitrogen and phosphorus in breakdown.

In further trials, at North Ryde, dipping in potassium carbonate solution increased weight-loss by up to 50 per cent during storage, and breakdown was reduced. This suggests that potassium carbonate could be used with the diphenylamine treatment to control superficial scald. It could also be useful to promote loss in weight during pre-cooling before placing Jonathan apples in plastic C.A. rooms, because these rooms operate at high humidity.

Post-Harvest Disorders—Injection of Metabolites

Injection of chemicals into the core of apples before storage has provided a simple method to study physiological disorders. The method was developed after finding that acetic acid accumulated in fruits that were exposed to low temperatures. In initial trials breakdown increased in fruit injected with acetic acid. In a further series of trials hexyl alcohol and hexyl acetate injections induced deep or soft scald in a line of Jonathan apples innately subject to the disorder. These hexyl compounds are naturally-occurring volatiles of apples.

Both breakdown and deep scald are caused by storage at too low a temperature. The foregoing evidence suggests that the disorders are produced by different disturbances to the apple's metabolism.

Herbicides

Trials at the Bathurst Station are examining the effects of high concentrations of herbicides on both mature and young apples. The prime purpose is to determine long-term effects on tree health. Application rates up to four times greater than those commercially recommended have been annual for the last 4 years.

On the mature trees the only damage this season was with diuron at three and four times the recommended rate. Yield was reduced by these treatments and by the highest rate of simazine (four times higher than recommended).

With young apples, again the only growth damage was where excessive diuron concentrations were used. Tree size has been increased in all the simazine plots; also where the lower rates of diuron were used, and by the heavy applications of amitrole (three times higher than the recommended).

Vegetative Propagation of Clonal Apple Rootstocks

Investigations continued towards a satisfactory alternative to the costly stooling or layering used to propagate clonal rootstocks. Progress has been made this year with the rooting of hard-wood cuttings. One of the treatments gave a 60 per cent strike. Past results with rooting of soft-wood cuttings have been disappointing but a method first used this year, the collection of juvenile cuttings with a heel of old wood, is promising. Some of the rootstock material responded poorly, but rooting in others ranged from 60 to 90 per cent.

RESEARCH—CITRUS INDUSTRIES

Citrus Rind Blemish

The initiation of rind blemish has been studied closely in 1969–70 by the specially appointed officer. The long-term objective is reduced incidence of rind blemish on coastal citrus.

The studies have shown that, at petal fall, the pedicels protect the fruitlets from injury (the pedicels at that stage having greater diameter than the fruitlets) but that within 2 weeks of petal fall the fruitlets became most susceptible to injury. Rubbing by leaf margins caused most injury, the abrasion occurring during high winds. Limbs, twigs, and dead wood were also found to be agents of abrasion.

Some 95 per cent of all fruit examined were blemished within 12 weeks of petal fall. After this the fruit seemingly began to develop resistance to abrasion.

Rootstock/Scion Incompatibility

Bark ring grafting as a means to predict rootstock/scion compatability is being investigated. Field experience has shown that the smooth seville orange is compatible with *Poncirus trifoliata* whereas some sevilles are not. Bark rings 14 mm long were reciprocally exchanged between *P. trifoliata* and each of the sevilles. Self grafts of all varieties were also made, to provide fully compatible controls.

Micro and macroscopic examination of radial and longitudinal sections of graft unions of the known incompatible combinations, at 40 and 60 days after grafting, revealed discontinuities of the recently formed vascular tissue. In some cases the abnormality was enough to girdle the plant, as indicated by starch accumulation above the graft union. But there was considerable variation between replicates, with some grafts appearing normal. With the self grafts and compatible combinations all were normal.

Hedging

Tree hedging treatments, rectangular and triangular design, were started on 9 year old double-planted Valencias at the Horticultural Research Station, Dareton. The purpose is to observe the effects on productivity when hedging is started whilst the trees are young. Experience elsewhere indicates that hedging, whilst it reduces tree size and facilitates harvesting, also reduces yield.

The start at Dareton has been made in an oncrop year, in an effort to offset alternate-bearing and thus even-out production. Treatments will be repeated as needed. The data will be collected over a period of years.

Similar tree-hedge shapes were pruned on older naval and Valencia trees at the Yanco Station, where tree reaction and cropping patterns will be compared with unhedged trees. The initial effect should be apparent in the ensuing season.

Post-Harvest Mould Control

This research at the Gosford Citrus Wastage Research Laboratory has concentrated on development of suitable post-harvest treatments for recommendation to citrus packing houses using thiabendazole (TBZ) to control fungal wastage. Over the past 4 years TBZ has been established as a most effective fungicide against green mould (*Penicillium digitatum*) and stem-end-rot (*Phomopsis citri*) of citrus under laboratory conditions, but commercial experience with the fungicide has been limited.

That TBZ is not phytotoxic and is therefore potentially preferable to sodium ortho-phenyl phenate (SOPP) has been shown. But there have been practical difficulties in adapting citrus washing and waxing procedures to the use of TBZ (insoluble in water). Two major problems were: to determine a practical method for chemical analysis of treatment-suspensions of TBZ; and to determine the loss of active ingredient in dips and sprays, caused by continuous treatment of fruit.

A method developed by the Chemistry Branch for analysis of TBZ suspensions will enable concentration-determinations to be made in laboratories. A second method, using a hand refractometer, also shows promise for spot-checking of TBZ concentrations.

A 30-second dip or flood treatment with TBZ after washing and before waxing has resulted in a slower fall of TBZ concentration in the treatment solution than a 2-minute dip in the conventional wash tank before brushing and cleaning. Studies on application methods and fungicide residues are continuing, to enable firm recommendations.

Controlled Atmosphere (*C.A.*) *and Air Storage*

Marsh grapefruit from Griffith, picked in June and August, were stored at 50° F in air or under polyethylene tents containing 16 per cent oxygen and 2 to 3 per cent carbon dioxide. The fruit harvested in June and stored for 20 weeks developed excessive decay irrespective of fungicidal treatment. The fruit picked in late August and stored for 12 weeks showed little fungal wastage. After storage, the palatability of this latter fruit was compared (by a panel of 80 observers) with that of freshly picked fruit from the same trees. About 75 per cent of judges preferred the fresh fruit but most rated as acceptable the fruit stored in air or C.A.

In another experiment, January-harvested Valencia oranges from the M.I.A. and from central coast were treated with fungicide and wax and stored for 12 weeks at 41° F under several C.A. enviroments and normal air storage. Fruit stored under C.A. were generally inferior to air stored fruit; with greater losses from fungal wastage and rind disorders. A palatability rating by a panel of 40 observers failed to show any consistent difference between treatments. The results confirmed a growing opinion that C.A. storage of Valencia oranges does not offer benefits over cool storage in air at 41° F.

Dwarf Orange Trees Investigations

A series of trials (initiated on behalf of the Citrus Improvement Committee), on controlled transmission of a dwarfing factor to selected orange budlines growing on trifoloata rootstock, is receiving world recognition. The object has been to reduce tree-size to allow high-density plantings of small trees, with attendant management economies.

Individual trials have indicated that a desired reduction in tree-size without deleterious side effects can be achieved with dwarfing budline strains, and that this is more satisfactory than using severe strains of exocortis. The latter cause an unhealthy appearance and decreased vigour.

Time-of-inoculation studies have shown the dwarfing effect to be greatest when trees are inoculated either in the nursery or soon after planting out.

Gibberellic Acid—Effect on Rind Quality

Studies of gibberellic acid (GA) spray treatment of navel orange trees, over two seasons at the Narara Station, have confirmed the beneficial rind-quality effects reported overseas. The rind of treated fruit aged less quickly and was more resistant to puncture and brushing injury. The GA treatment also reduced losses due to water spot, and significantly reduced post-harvest mould wastage.

In a GA study on Marsh grapefruit at the Yanco Station, trees were sprayed in June and sampled at monthly intervals from September to April. While skin firmness of the fruit decreased with time all GA concentrations improved firmness over controls. The GA treatments also appeared to reduce rind roughness, and to maintain a higher juice and sugar content. The trial will be repeated.

RESEARCH—TROPICAL FRUIT INDUSTRIES

Banana Nutrition

Sand Culture Pot Trial.—After 2 years of preparation an experiment to study K:Mg:Mn interactions in bananas was started at Alstonville Tropical Fruit Research Station. The main objective is to study the nutritional factors associated with the "banana decline" condition ocurring in certain areas of New South Wales banana districts.

Initiation of this pot experiment followed a pilot trial which indicated that plant behaviour differences associated with nutrient application could be expected with pot-grown banana plants. The trial is only in an early stage but data on growth measurements, drainage, water usage and nutrient balance are being obtained and analysed.

The most obvious differences to date relate to potash. The results indicate that nutrient level within the leaf is closely related to soil nutrient application.

A Leaf Sampling Method.—The 4 years' data from this trial, now ended, are being analysed to assess the leaf-sampling methods best suited to reflect the plant's nutrient status. There is extreme variability in the data but preliminary analysis has shown for all elements except magnesium a significant effect of leaf position, for all elements except phosphorus and zinc a significant effect of plant age, and for all elements, except manganese in one year, a significant effect of month-of-sampling.

Statistical Analysis of Banana Field Trials

An improved method for the analysis of banana yield data has been developed in association with the Biometrical Branch. Periodic regression analysis is applied to define the yield/climate interaction. When yields of a factorial, NPK field-trial were adjusted, using this method, the coefficient of variation was reduced from 45 per cent to 23 per cent. Development of this technique should enable more efficient use of classical field-trials in banana research and better the interpretation of data.

Banana Plant Growth Studies

Irrigation and fertilizer application problems of preliminary investigations in the controlled-environment growth-chamber at Alstonville Station have been overcome. Studies have shown that leaf elongation in both the Highgate and Williams varieties ceased at 50° F, but that Williams responded more rapidly when returned to higher temperatures. This work indicates that the growth-chamber could be used to assess cold-tolerance of varieties.

Field work on ontogenetic development of the banana was completed. A growth curve was established for the whole plant and various plant-parts during the first 18 months of growth. The work has shown that: leaf efficiency is closely related to total amount of solar radiation received; desuckering may seriously reduce root numbers; a high proportion of live roots attached to the stool originated from gouged suckers; ratoon crop suckers are initiated early in the life of the parent plant: and sucker growth inhibits development of potential lateral buds.

The data collected also suggest that under the solar radiation enviroment at Alstonville a theoretical yield of double that now being achieved is possible, and that yields are now limited by such other factors as nutrition, nematodes, and irrigation.

Banana Post-Harvest Studies

The Alstonville Station programme on behalf of the Banana Research Advisory Committee has continued.

Data on post-harvest handling and packaging aspects demonstrated that fruit injury increased with each handling operation, and that unbagged summer fruit showed a higher level of injury than did similarly treated winter fruit when transport to market was simulated. The transport of bunches to the place of pick-up and of packages to market were the main occurrence-points of injury.

Studies on the effects of ripening and post-ripening storage temperatures, on winter and summer grown bananas, indicated that skin colour change was more rapid in the later stages of ripening at 70° F than at 64° F and that the higher ripening temperature reduced the "colour life" of fruit held after ripening at either 56° of 65° F.

In co-operation with the Biology Branch, research into the use of thiabendazole (TBZ) for post-harvest disease control continued. Emphasis was on the examination of TBZ use under commercial conditions. Information was collected on the stripping rate of TBZ, its chemical behaviour and fungicidal efficiency, in trials done in several growers' packing sheds. These trials have yielded a recommendation to the industry on TBZ use for control of post-harvest rots.

Evaluation of the transport of bananas in sealed polyethylene bags inside fibreboard containers, using an ethylene absorbent in each bag, continued; with long distance trials. Preliminary recommendations have been made.

This concept of modified atmosphere storage was extended to the field, to delay harvesting by sealing the bunches in heavy gauge bunch-covers. Indications are that maturity is delayed in the modified atmospheres produced within the cover, but that growth continues. So far, ethylene accumulation within the cover does not appear to have adverse effect.

Banana Sterilization Against Queensland Fruit Fly

Ethylene Dibromide (*E.D.B.*) *Fumigation.*—Studies continued at Gosford Citrus Wastage Research Laboratory. Winter bananas from the extreme southern growing-areas in New South Wales and extreme northern growing-areas in Queensland were fumigated with a range of E.D.B. concentrations, for a standard time and at a standard temperature. Fruit fumigated with 10 oz E.D.B. per 1,000 cu ft was uninjured. Higher doses caused varying degrees of injury.

Insecticidal Dip Treatments.—In tests, dimethoate plus thiabendazole caused high mortality of eggs and larvae. Work is proceeding on maintenance of dip concentration, persistence of residues, and mortality of pupae.

Avocadoes

Sunblotch Virus.—Confirmation of avocado sunblotch virus in 3 trees of Mexican-race parentage at Alstonville led to removal of these and the quarantine of all other trees on the Station. No further symptoms have developed but all remaining trees at the Station will be indexed before release of bud wood is further considered.

Establishment Studies.—At Dareton (far south-west of New South Wales) it has been shown that establishment of avocadoes in this harsh enviroment depends on shade, shelter from frosts, and the maintenance of adequate soil moisture.

Macadamia Nut Propagation Methods

Following success of previous work on seed grafting, studies are continuing at Narara Station. The method developed for this type of propagation has been very successfully applied by at least one commercial grower. Present studies are examining means to increase seed germination-percentage in the glasshouse.

Passionfruit Breeding and Selection

Breeding and selection for *Fusarium*-wilt resistance is continuing at the Narara Station. Using a soil inoculation method, cuttings of agronomically acceptable hybrids are being propagated for a study of resistance to the organism.

RESEARCH—GRAPE INDUSTRIES

Pruning, Training and Spacing of Wine Grapes

Pruning, training and spacing trials planted in 1962 were continued at Griffith Viticultural Research Station.

Black Shiraz.—Vines trained on a 15 in wide T-trellis outyielded by about 10 per cent those trained on a standard single-wire trellis. This reversed the previous trend wherein differences between the two were diminishing.

As previously reported, there was little yield difference between vines pruned to four different methods.

Semillon.—Vines trained on a 15 in wide trellis and pruned to spurs gave the best yield in a trial comparing rod and spur pruning methods, on vines trained to either single-wire or T-trellises. Vines pruned to rods, trained on single-wire trellises, tended to give the lowest yields. Yield differences were related to the number of buds left on each vine at pruning and the percentage of these buds producing fruit.

Gordo Blanco.—This trial, comparing 7 ft and 4 ft within-row vine spacings, single-wire and 15 in T-trellises, and 4 different levels of pruning, gave results similar to those of previous years. On an acreage basis: vines planted 4 ft apart within the rows outyielded by 25 per cent the vines planted 7 ft apart within the rows, while those trained on T-trellises yielded only slightly higher than those on standard single-wire trellises. Because of high fruitfulness of basal buds in this variety, there was little difference in yield between the 4 levels of pruning-severity.

Black Shiraz; Spacing and Trellising

In 1969 a comprehensive spacing and trellising trial was planted at the Griffith Station to study the performance of Black Shiraz vines grown in various vine-spacing and trellising arrangements. Combinations of between-row spacings of 5, 7½, 10 and 15 ft and within-row spacings of 5, 7½ and 10 ft are being compared. The trial also compares the relative merits of narrow row-spacings and standard trellises with wide row-spacings and wide T-trellises. Trellises were installed in 1970. Collection of yield data should start in 1972.

Mechanical Harvesting

Investigations into mechanical harvesting of wine grape and dried vine-fruit varieties are being conducted mainly by the CSIRO Division of Horticultural Research at Merbein, but developments in this field have been closely followed by the Division of Horticulture.

Liaison is close with a grower at Gol Gol who has developed and tested a prototype grape-harvester. This local machine has shown much more promise in field tests than its more expensive American counterparts being tested by the CSIRO. It requires a wide flexible T-trellis while the most promising of the American machines operates on a standard single-wire trellis.

A self-propelled second prototype is now being constructed. This will be tested during the 1971 vintage at Griffith along with the American machines. Wide flexible T=trellises are installed on a newly planted block of vines at the Griffith Station to provide a further test site for mechanical harvesting.

Sprays of ethrel, by loosening berries from the bunch, reduced the force required to harvest sultanas mechanically. The treatment also eliminated berry splitting of machine-harvested sultanas.

Sultana Pruning and Wrapping

Because of the low fruitfulness of the more basal buds on shoots, sultanas have to be pruned to canes or long rods. By this method of pruning, the shoots that develop from the basal buds of canes laid down in the previous winter are used as a source of replacement canes for the next winter's pruning. Often not enough of these shoots develop near the crown of the vine and thus not enough canes are available for the following crop.

A trial was initiated in 1969 at the Dareton Station to determine whether this problem could be overcome by leaving replacement spurs in the crown of the vine or crossing over the crown of the vine with canes during wrapping down to ensure complete filling of the trellis. In the first crop harvested from the trial in 1970 no treatment-differences were apparent.

Clonal Selection

Black Shiraz and Semillon.—Cuttings selected from these two varieties in Hunter Valley and M.I.A. vineyards during 1968–69 have been planted out at the Griffith Station in 2 lattice-design trials for initial comparison; 81 Black Shiraz and 64 Semillon clones are being compared.

Yield differences between the highest and lowest yielding groups of Shiraz vines planted at Griffith over the past 6 years have approximated 50 per cent. Leaf roll virus symptoms are associated with the lowest-yielding vines.

The top yielding clones will be multiplied this year for release to local growers as source plantings. Sufficient cuttings are available to establish 20 acres. Virus-indexing of promising clones of Black Shiraz and other varieties is being conducted by the Biology Branch.

Cabernet Sauvignon.—Twenty vines from the original planting of this variety in the M.I.A. were selected on yield performance. As all these vines were observed to have mild leaf roll symptoms, 30 more vines have been selected as apparently free from this virus. Other selections have been made in Forbes and Hunter Valley vineyards, to be planted in a comparison trial at the Griffith Station.

Currants.—At the Dareton Station, 18 high yielding vines were selected. These will be planted in a comparison trial, together with five selections made by the Victorian Department of Agriculture and a selection from California. The local selections include an outstanding high-yielding, large-bunched mutant.

Radiation Environment

A field technique was developed to investigate the complex of light-environment and leaf distribution affecting photosynthesis in the vine canopy.

The canopy was partitioned into layers, for estimation of photosynthesis due to diffuse light absorption. Light intensities were measured with a selenium photocell, and leaf-area distribution was measured following harvest of leaves from the appropriate layers.

Preliminary results indicated that, to achieve the separation of leaves necessary for optimal usage of light, the canopy of a vigorous, irrigated grape vine needs more support than is provided by a single foliage-wire. This complements previous conclusions that present trellising arrangements provide inefficient light-utilization.

Nematode-Resistant Rootstock Trial

The extensive Gordo Blanco rootstock trial at Dareton Station has ceased because of extreme variation between vines. It will be replanted only when virus-free stock and scion material is available, as the differences between stock and scion combinations may merely be reflecting virus status rather than genetic differences. Incompatibility of Salt Creek rootstock and the Gordo Blanco variety occurred in the trial, probably through leaf roll virus infection.

Fruit-Setting, Berry-Sizing and "Picking-Force" Chemicals

The effects of alar and cycocel sprays on Cabernet Sauvignon were investigated on whole vines.

Sprays of cycocel ranging in concentration from 125 to 1,200 ppm, applied before bloom, gave significant increases in fruit set and yield, despite reduced berry size. Greatest responses were by proximal bunches. Mild leaf-toxicity symptoms were seen at all concentrations, but results were promising enough to suggest that small-scale commercial trials are warranted. Responses to alar sprays ranging from 1,000 to 4,000 ppm, applied before bloom, increased fruit set but not the yield—because of reduced berry size.

Gibberellic acid (G.A.), cycocel and P.C.P.A. to improve fruit set and berry size of currants were studied. Treatments included 20 ppm P.C.P.A. applied at 3 different stages; 30 ppm cycocel, plus a single cincture-cut; 100 ppm cycocel plus 1 ppm gibberellic acid; 2 different concentrations of gibberellic acid applied 3 days after cap fall, and a single cincture-cut. Higher yields were had from all cinctured vines regardless of application of growth regulator, and by applying P.C.P.A. at shatter or post-shatter. Yield from these treatments was twice that of the untreated vines. Increased berry size, rather than fruit set, caused the yield increases.

G.A. sprays applied to Black Muscat again gave variable results.

G.A. alone, and complemented by sprays of P.C.P.A., failed to significantly increase berry size or yield when applied to sultana vines. Bunch trimming before fruit set did not reduce ultimate bunch size, as a greater percentage of the flowers that remained after trimming formed berries.

No change in sugar content, acid content, skin colour or "berry picking force" resulted from ethrel applied to single bunches of Black Shiraz on a range of dates from flowering to maturity. However an earlier trial with this variety and the varieties sultana and Nyora indicated that ethrel sprays applied at maturity, on whole vines, substantially reduced the work force needed to remove individual berries from the bunch. Leaf and petiole analyses of vines treated with ethrel indicated that sodium and chloride levels were markedly increased.

In an attempt to thin berries from bunches of Cornichon grapes, crop reduction was dramatic where concentrations of 100 ppm of ethrel were applied before flowering. But the thinning effect was by removal of whole bunches rather than the desired removal of individual berries.

Vine Slashing

In a trial of slashing at Griffith Station on Black Shiraz, to study the effects of leaf number and leaf distribution on fruit sizing and maturation, vine shoots were shortened on five dates ranging from late October to late January. Shortenings were by cutting back the shoot to within either 6 or 2 leaves above the upper bunch on the shoot.

Because of shoot regeneration, the slashing had no effect on berry weight. But slashing from mid-December till the end of January reduced the sugar content. As the slashings were quite severe, it would seem that slashing or tipping as practised in commercial vineyards does little harm.

RESEARCH—STONE FRUIT INDUSTRIES

Variety Trials

Canning Fruits.—Progress reports on canning peach variety evaluation trials at Yanco Station have been prepared. Canned samples and field data of all varieties in the 1962 plantings will now be critically examined, to select the most promising for evaluation in greater detail and to end the recordings on other varieties.

Variety introductions from California and South Africa, planted in 1966, cropped for the first time and showed useful qualities. Sixty-nine Golden Queen cross seedling selections from the 1964 breeding programme at Yanco also cropped for the first time. The most promising of these have been selected for further testing after an examination of canned samples.

Of 16 apricot selections planted in 1962, two have produced acceptable quality canned samples. But all failed to crop as well as Trevatt, the main canning variety grown in the M.I.A. One of the Yanco selections (YA.54/13) matures late, produces an excellent canning sample and, if its cropping improves as the trees become older, would be useful to extend the harvesting season.

Some apricot introductions from Canada, planted in 1964, are promising but the trees are too young for proper evaluation of variety performance.

A peach variety (Walgent) and 3 apricot varieties (Peeko, Bulida and Royal B) have been introduced from South Africa and are in quarantine for screening.

Dessert Peaches.—More information was gained on varieties under test at Bathurst and Narara Stations and at Hawkesbury Agricultural College. Coronet produced fruit of outstanding appearance and quality, and condition was well maintained during marketing. Trees in district plots at Arcadia, Glenorie, Menangle and Bilpin grew well, and produced some fruit for the first time. Further studies were made on the winter chilling requirements of the varieties under test.

Growers are keenly interested in the new varieties; so Maygold, Starking Delicious and Coronet are being planted in coastal districts. Redhaven, Fragar and Glenalton are other fairly recent releases now being planted commercially.

Nectarines.—The Nectared series, yellow-fleshed nectarines, has been established in trials at Bathurst Station and Hawkesbury College, and in district plots in the major, dessert-fruit producing-areas. It is too early yet to evaluate them.

Additional yellow-fleshed nectarine varieties have been introduced from the U.S.A. and are in quarantine for screening. These include Le Grant (previously held under patent), Independence (bred in California) and Flavortop and Fantasia recommended by the U.S.D.A. Plant Introduction Section.

Prunes.—Fruit from two d'Agen strains that may be useful to extend the harvesting season have been processed for quality evaluation.

Clonal Strain Selections.—Collection of propagating material from outstanding-performance trees has continued. Besides the previous propagations of strains of J. H. Hale and Golden Queen, 3 early and 3 late Queen selections have been collected and propagated for comparison in trial plantings. Selections of Trevatt apricots, d'Agen prunes, Goldmine nectarines and other peach varieties are being held until numbers are sufficient for testing.

Nuts.—Trees of available filbert and walnut varieties have been propagated at Bathurst, for establishment of a variety collection at Orange Agricultural Research Station. Some recently introduced almond varieties are being tested at Wagga Agricultural College.

Rootstocks

Peaches.—Trial plantings to compare commonly used peach seedlings with seedlings of 2 introduced nematode-resistant varieties have been established. They are on land not previously planted to fruit trees at Bathurst Station, and in a replant-situation at Yanco Station.

Apricots.—In a trial planted in 1968 at Yanco Station to compare apricot seedlings and Buck plum as rootstocks for apricots under irrigation, trees on Buck plum have grown the more vigorously.

Prunes.—Results from old trials of prune rootstocks at Yenda and Young were re-evaluated after re-examining the plots. Semi-dwarf trees on the Department's Marianna selection PS1A were observed to have cropped almost as well as much larger trees on other stocks. With slightly closer planting, yields per acre on this rootstock may exceed those from the wider spacings needed for trees on Buck plum and Myrobalan.

At Yanco Station a trial has been initiated to examine the influence of rootstock material from East Malling, England, on tree size and fruit quality; also to test the effect of intermediate stem pieces worked on Buck plum with d'Agen prune as a scion variety.

Cherries.—A virus-free clonal selection of F.12/1 is being increased in Departmental nurser ie at the Narara and Bathurst Stations. Mahaleb seed, for raising rootstocks, is being produced from virus-free material in isolated conditions at the Glen Innes and Bathurst Stations.

The Deciduous Fruit Tree Improvement Scheme

Continued, Departmental inspection of parent trees to be used by nurserymen as a source of budwood has reduced the risk of producing and using virus-infected trees.

The Division of Horticulture continued to co-operate with the Biology Branch in collecting peach and apricot specimens for virus-indexing. The indexing programme is aimed at establishing the relative incidence of various virus strains involved in peach rosette and similar conditions seen in peaches in the M.I.A., and various virus symptoms detected in apricots. A comprehensive survey was made of an apricot "decline" at Kurrajong causing tree losses in early apricot varieties.

Trees are being propagated from virus-free canning-peach variety scion material received from Victoria, and from selected source-trees of other varieties, for further studies of the incidence and spread of virus conditions in stone fruits.

Tree Training

Mechanical Harvesting.—A trial with canning peaches was established at Yanco Station, and prune trees were planted on growers' properties in the Young district, for initial studies on the training of trees to forms thought to be best suited for mechanical harvesting.

Developments with prune harvesting have been kept under observation, and it is apparent that tree-shaking methods of harvesting would require trees to be headed higher than usual. High-heading, however, exposes young trees to sun scald. Methods to protect butts against this risk will be examined.

Close Planting.—Pilot trials will be established at Bathurst and Yanco Stations, with dessert and canning peaches, to examine training methods suitable for intensive plantings. Success has been achieved overseas, but close planting using conventional training methods has so far been unsuccessful in Australia.

Thinning and Sizing

Fruit development and sizing studies are to have high priority, and past investigations of chemical thinning have been reviewed.

New trials were initiated at Yanco and Bathurst but heavy frosts during blossoming reduced the potential crop—enough to affect the results.

Some promising results were had in initial trials on peaches and plums in coastal orchards with ethephon and another new chemical formulation.

Trials to study the interaction between levels of thinning and nitrogen applications will be started at Yanco Station. Further work at Bathurst and in coastal orchards awaits the filling of the vacant research position at Bathurst Station.

Herbicides

A herbicide-management trial incorporating the pre-emergent, terbacil, was initiated in mature canning peach trees. No significant differences in tree performance were observed in the first season.

Some phytotoxic effects were noted in apricots and peaches where terbacil and a wetting agent were used at varying concentrations. The concentration of the wetting agent appeared to influence symptom-intensity more than did increased concentrations of terbacil. Investigations into management aspects and phytotoxic effects of terbacil will continue.

Post Harvest Rot Control

Trials during the 1969–70 summer in the Kurrajong district and at Young indicated that the effectiveness of aqueous suspensions of thiabendazole and benomyl dips for control of brown rot in apricots and cherries was undiminished by holding diluted dips for a period of up to 7 days.

In a further series of trials benomyl, daconil, and TD5056, but not thiabendazole, partially reduced transit rot (*Rhizopus nigricans*) in peaches. Of the many fungicides screened at Bathurst during the last few years, none has effectively controlled transit rots. None of the fungicides named in this paragraph has yet been cleared by Health authorities.

RESEARCH—STRAWBERRY INDUSTRY

Breeding

The breeding programme continued at Narara Station. Ten selections were made from seedlings raised in 1969. Testing of one 1969 selection, three 1968 selections, and two 1967 selections is continuing. The 2 promising 1967 selections have also been established in district plots for further evaluation.

Many earlier selections that have shown promise in other directions have developed susceptibility to common strawberry diseases. More attention will be given to this in the breeding programme.

Variety Trials

A variety trial at Bathurst demonstrated the superiority of Red Gauntlet, Cambridge Favourite and Cambridge Vigour for tableland conditions. The recently introduced Tioga also did well. Tioga produced highest yields in variety trials at Narara and was promising in coastal district plots. Torrey, a variety tested and released from Narara a few years ago, is still the most favoured for commercial, coastal plantings.

Supply of Certified Planting Material

Virus-free strawberry plantings of the more common varieties in use were raised in isolation at the Somersby section of the Narara Station and distributed to runner-plant growers. With rapid expansion of the industry, quantities distributed were inadequate. The possibility of establishing a full-scale, strawberry plant certification scheme is under investigation.

IRRIGATION AND DRAINAGE RESEARCH

Irrigation

Plantings Establishment.—Evaluation of the trickle irrigation technique with new plantings of fruit under inland irrigation conditions has started at Yanco Station. Citrus, apples, peaches, and grape vines were subjected to 4 application rates to replace 40, 60, 70, and 80 per cent of the net evaporation from the wetted soil area. There were also 2 soil surface treatments; bare soil and black polyethylene mulch.

Initial observations in that work have shown clearly the water requirement for peaches in the first year of establishment to be greater than that for apples, citrus, or vines. Above-average, late summer–autumn rains appeared to eliminate any differences between the various treatments, except that autumn growth was better on the polyethylene-mulched citrus trees.

At Bathurst, 3-year old peach trees were given supplementary trickle irrigation treatments. Again the above-average rains limited the results.

Preliminary work at Alstonville Station has enabled wetting-patterns and discharge rates to be determined before the start of a trickle irrigation field trial with bananas.

Mature Plantings.—Bearing trees of 3 apple varieties at Bathurst Station have been subjected to trickle irrigation treatments equal to 20, 40, and 60 per cent of water lost by evaporation based on losses from a standard pan-evaporimeter. The season was good, with better than average rainfall, but yields appeared to be increased by trickle irrigation. Under the conditions, the 60 per cent treatment caused waterlogging. Reduction of all treatment rates was essential as the season progressed.

Several trickle application rates were applied to mature double-planted citrus trees at Narara Station. The actual quantity of water applied each day, and the interval without irrigation following rain, were based on net daily evaporation. The dry autumn and early winter caused all treatments to show stress, indicating either that the trees had not adapted to the technique or that insufficient water was being applied.

The possibility of a water-budget method to determine the water need of bananas, using ground level sprinklers, is being investigated at Alstonville Station. Results so far indicate that a budget based on evapotranspiration is a more accurate guide than one based on soil moisture measurement. Substantial yield responses have resulted from frequently applied low application rates on the clay loam soil at the Station. Frequency of application appears to be more important than rate.

Studies on the effect of soil moisture regimes on the banana plant physiology have shown that moisture stress detrimentally affects yield, in terms of bunch weight and size grades.

At Griffith Station, treatments in the Black Shiraz irrigation trial were varied to allow the study of trickle irrigation. But the original concept of the trial, whereby moisture stress was applied to the vines at critical stages during the growing seasons, has been retained. The new treatments permit comparisons between trickle and furrow irrigation methods, as well as between the effects of various rates and quantities of irrigation application through a trickle irrigation system. The frequency of irrigation and the quantity of water applied by trickle irrigation were based on daily evaporation recordings.

In the first year of that work there has been little difference between yields of vines trickle-irrigated, on a daily or 2-day basis, or vines irrigated by normal furrow-methods. Yields were suppressed by withholding water during the periods from bud burst to veraison and from veraison to harvest. A completely satisfactory method of measuring plant water deficits has yet to be developed.

In conjunction with the irrigation field trials at Griffith the effect of varying soil moisture levels, on vine root development, was studied in a root chamber. The roots were trained into perspex and glass-covered boxes in an underground chamber, and their growth measured. Because of the roots' ability to penetrate dividing walls between the various chambers, no firm conclusion was possible this season.

Tile Drainage

The study of agronomic responses of oranges, grapes, peaches, and prunes to various depths and spacings of the drains continued at Griffith Station.

Following soil saturation by flood irrigation in late September, 1968 and April, 1969, followed immediately by heavy rains and continual wet weather during the winter months, some losses and damage occurred to peach trees planted between the more widely spaced and shallower drains. Drains installed at the 60 ft spacing and 5 ft depth recommended for the test site gave adequate protection against waterlogging. No damage due to waterlogging occurred in the other test crops.

Data collected suggest that the period during which water tables persist shallower than 1·5 ft from the surface is critical with respect to peach tree injury.

RESEARCH STATIONS AND LABORATORIES AFFECTING THE FRUIT INDUSTRIES

Alstonville Tropical Fruit Research Station

Office and laboratory extensions were completed and are now occupied by the research staff.

Extensions to the packing house were completed. These will allow installation of more sophisticated banana-washing and waxing equipment. A mains water-supply was laid to the Station and irrigation laterals were extended to new areas.

Bathurst Agricultural Research Station

Renovations to existing buildings improved the laboratory accommodation; by conversion of an old store to modern laboratory space for fruit research officers. Packing shed improvements included installation of a modern double-sided P.S.F. rotary bin grader and creep feed hopper and better lighting.

Dareton Horticultural Research Station

An alternative, irrigation water supply direct from the Murray River has been installed; interconnected with the old reticulation system from the Water Conservation and Irrigation Commission supply. Until this installation the Station was tied to the time roster, for irrigation, that lacked the needed flexibility for horticultural and irrigation research.

A Lane, late navel rootstock trial was planted and made progress. More varieties were included in the citrus mother-tree block initiated in 1967 to provide a certified-budwood supply for New South Wales nurserymen. An apple variety collection was established to assess the performances under these climatic conditions. A grape vine varieties collection was started with the planting of 60 wine, table, drying, and rootstock varieties.

Gosford Citrus Wastage Research Laboratory

Co-operative investigations with the CSIRO Division of Food Preservation continued; on citrus fruit handling, decay control, and disinfestation of bananas against Queensland fruit fly. The latter project will end this year. Then a programme of disinfestation against Queensland fruit fly in tomatoes will start.

Griffith Viticultural Research Station

New plantings included a Black Shiraz spacing and trellising trial, clonal-selection assessment trials, and a Black Shiraz planting for short-term experiments. The external, irrigation supply ditch was tapped by a small pump to provide regular supply to the trickle system now installed in the irrigation trial. Arrangements have been made for drain installations in an 11 acre block leased for future research plantings. A 16 ft x 12 ft heated bed and mist propagator were installed in the glass-house, for rapid multiplication of clonal selections and new varieties.

Narara Horticultural Research Station

Development of all usable land in the newly cleared portion at Somersby section progressed favourably and materials were purchased for irrigation and drainage installations. A Lane, late navel rootstock trial planted last spring became the first planting in the new area.

Production of virus-tested strawberry plants for distribution to runner-growers continued at Somersby and a new area was cleared to extend these plantings.

North Ryde Fruit Preservation Research Laboratory

Storage investigations in co-operation with the CSIRO Division of Food Preservation continued. Effects of long distance transport of bananas after packaging of hands in polyethylene bags, and development of the plastic-tent method for C.A. storage of apples are current studies.

Orange Agricultural Research Station

The first stage of a comprehensive trial with applies, to compare four tree-training systems in three varieties, each on four rootstocks, has been planted. The second stage will be planted in the ensuing year. Establishment of a Pome Fruit Arboretum has started with the planting of 25 varieties.

Yanco Agricultural College and Research Station

Re-organization of the stone fruit research programme led to removal of 300 ageing trees from terminated trial plots and variety collections. For these old orchard sites, new plantings are planned—to test selected peach rootstocks, clonal peach-selections, and recently introduced rootstocks. An extra area has been developed to accommodate proposed new peach plantings; for a short-term trial block and for initial examination of tree training methods. An automatic bin filler has improved and speeded operations in the packing shed. An irrigation trial to assess trickle-irrigation for establishment of citrus, vines, peaches and apples was started.

Hawkesbury Agricultural College Orchard

Plantings for demonstrations to students were maintained. Establishment of 60 trees of 19 peach varieties planted in 1967 and 48 trees of 8 nectarine varieties planted in 1968–69 progressed well. The peaches produced a small quantity of fruit. The nectarines are expected to crop next year. Other demonstration plantings for students include: trickle and draghose installations; use of soil-moisture testing equipment; use of herbicides in a range of fruits; soil management; tree planting and training methods; and winter-chilling needs of trees.

Wagga Agricultural College Orchard

Stone fruit, citrus and vine plantings for demonstrations to students were maintained; also almond and olive variety collections, and a small demonstrational planting of strawberries. A new building now provides a demonstration area and better office space. The packing shed has been renovated. A rotary bin grader and a small dehydrator have been installed; the latter capable of operating either as a parallel or counterflow drier.

COMMITTEES AFFECTING RESEARCH

Fresh Fruit Disinfestation Committee

This Committee comprises representatives of the Commonwealth Department of Primary Industry, Queensland Department of Primary Industries, the CSIRO and the State Departments of Agriculture of N.S.W., Victoria and South Australia. Investigations, centred at the Citrus Wastage Research Laboratory, Gosford, on sterilization of Queensland fruit fly in bananas will end during 1970. Then a programme on sterilization in tomatoes will start.

Banana Research Advisory Committee

Representatives of the Commonwealth Department of Primary Industry, the CSIRO, Queensland Department of Primary Industries, N.S.W. Department of Agriculture and the Australian Banana Growers' Federation comprise the Committee. Annual meetings review the banana post-harvest research programme undertaken at the Alstonville Tropical Fruit Research Station, the Sandy Trout Food Preservation Research Laboratory of the Queensland Department of Primary Industries, and the CSIRO Division of Food Preservation, North Ryde. A Technical Sub-Committee meets prior to the main Committee. This year's meeting of the main Committee considered the 7 years' research since formation of the Committee (a review prepared by the Technical Sub-Committee).

The Committee also sponsors an annual meeting of investigators to discuss details of the investigations and formulate lines of future research. The last meeting was held at the Horticultural Research Station, Redlands, Queensland.

Banana Containers Committee

Representatives of the New South Wales banana industry and the Division of Horticulture comprise this Committee and suggest, to the Packaging Sub-Committee of the Banana Research Advisory Committee, investigations into size, type and packing patterns for New South Wales containers.

Banana Weevil Borer Committee

This comprises representatives of the Banana Diseases Control and Development Co-operative Ltd and the N.S.W. Department of Agriculture. Finance is provided by the Co-operative. Currently the programme to contain and control weevil borer infestations in the Coffs Harbour/Nambucca area is directed towards a situation survey to define the extent of infestations, and a detection and treatment scheme.

Banana Processing Committee

The Department is represented in this New South Wales industry committee. The Committee examines the potential of banana by-products and processing, for disposal of banana surplus in time of over-production. A study of feasibility of processing surplus bananas was completed this year.

N.S.W. Avocado Advisory Committee

This was constituted in 1970 under the aegis of the Banana Growers' Federation, to advise on the development of the avocado industry. The Department is represented in a technical advisory capacity.

Citrus Improvement Committee

This is a Departmental Committee comprising senior officers of the Division of Horticulture and the Biology Branch. Two meetings this year reviewed the progress of Committee projects and arranged propagations for new citrus-research projects. Two papers relating to the Committee's work were presented to International Conferences this year.

Citrus Wastage Research Committee

This comprises representatives of the Department and the CSIRO Division of Food Preservation and met at Gosford twice this year to review progress of current research programmes and other activities of the Citrus Wastage Research Laboratory. The Committee proposed that recommendations be made to the citrus industry, as soon as studies on commercial usage and stability of the fungicide end, on the use of TBZ for control of mould wastage after harvest.

Committee for Fruit and Vegetable Storage Investigations in N.S.W.

Formerly known as the Advisory Committee on Fruit Cool Storage Investigations in N.S.W. the Committee was re-constituted this year. It comprises representatives from the N.S.W. Department of Agriculture, the CSIRO Division of Food Preservation, and Universities in the Sydney area. Terms of reference of the new Committee are similar to those of the earlier Committee, but the Sub-Committee role of the Citrus Wastage Research Committee has been terminated to enable the latter to function in its own right.

Murray Citrus Sub-Committee

This Sub-Committee of the Commonwealth Committee for Co-ordination of Fruit and Vegetable Storage Research met in Victoria at Scoresby Horticultural Research Station, in December, 1969. Problems associated with the commercial application of TBZ were discussed. The Committee also proposed that a school for horticultural extension officers be held at Gosford in 1971, on post-harvest handling and treatment of citrus fruit. (The parent Commonwealth Committee for Co-ordination of Fruit and Vegetable Storage Research meets only biennially and did not meet in 1969.)

Co-operative Citrus Bud Selection Society Ltd

The Society is a non profit-making organization. It has operated for 40 years, for collection and distribution of selected budwood to nurserymen. The Committee of the Society includes representatives from nurserymen, citrus growers and the Department. Because of the problems associated with the supply of certified budwood from approved blocks of trees on private orchards, the Department several years ago started a parent tree planting at the Horticultural Research Station, Dareton. The planting embraces all commercial varieties. These trees have progressed satisfactorily and budwood should be available within two to three years.

Central Coast Agricultural Research and Extension Committee

This industry sponsored Committee (C.C.A.R.E.C.) assists the co-ordination of agricultural research and extension in the Gosford/Wyong districts. C.C.A.R.E.C. actively organizes field days on topical subjects. This year citrus-hedging and trickle-irrigation were featured. It was also instrumental in securing appointment of a Departmental research officer now investigating citrus rind-blemish, and provided substantial funds (matched by the Commonwealth) towards purchase of research equipment for the officer.

Citrus Nutrition Committee

This comprises members from the Division of Horticulture and the Chemistry Branch. Under its auspices, a 5-year survey providing analyses of citrus leaves from 150 citrus orchards throughout the State was done. The resulting data are being analysed by computer. Progress results have been used at several nutrition field days this year and have enabled some modifications to fertilizer recommendations.

Vine Improvement Research Committee

The Committee comprises representatives from State Departments of Agriculture, the CSIRO, the Australian Wine Research Institute, and the Australian Wine and Dried Vine Fruit Industries. At the annual meeting the Committee reviewed the past season's progress on vine-improvement research. Items discussed were assessment of wine grape quality, nematode-resistant rootstocks and their propagation, clonal selection, nomenclature of clones, vine breeding, variety importations, and trellising needs for wine grapes.

M.I.A. Irrigation Research and Extension Committee

This Committee (I.R.E.C.) continued to review research and extension needs in the M.I.A. Most fruit-growing matters were handled by a Horticultural Sub-Committee. Some were referred to the Department for attention.

The usual census of fruit tree plantings was undertaken. A Planting Trends Report was prepared from the census. Work on peach leaf analysis studies was reviewed and a recommendation was made that the studies continue for the full five years as initially proposed.

Viticultural Sub-Committee to I.R.E.C.

Two meetings were held. The Sub-Committee was formed to enlist industry guidance and support for the research programme of the Viticultural Research Station. Research activities at the Station were inspected and at a meeting in June, 1970, results of trials were discussed, together with prospects for studies on vine nutrition and the propagation of high quality vine planting material for wine and table grapes.

The Committee also outlined at the request of Departmental Economics Research Officers, industry needs with respect to proposed studies on the economics of wine grape production in the M.I.A. Priority was given to a survey on the cost of vineyard establishment.

Committee for Co-ordination of Fruit and Vegetable Processing Research

The Committee comprises representatives of the CSIRO, the N.S.W. Department of Agriculture, the University of New South Wales and the canning industry within this State. At this year's meeting a report from a Sub-Committee investigating the breakdown of apricots in cans presented evidence that a heat-resisting enzyme produced by a soft rot organism (*Rhizopus*) may be mainly responsible.

A report on work being done at the University of New South Wales, on the production of Kamaradin (a dried apricot puree), and colour-pigment investigations on canning peaches, was presented to the meeting. So too was a report on the M.I.A. Canning Peach Conference (held in 1969). Other agenda items dealt with various aspects of processing, solid packs for apples, frozen strawberries, banana products, and various vegetable products.

Deciduous Fruit Tree Improvement Committee

This Committee of officers of the Division of Horticulture and the Biology Branch aims to prevent the spread of virus diseases; by selection of suitable propagating material and by making the selections available to nurserymen. This year the virus position of canning peaches in the M.I.A. continued to receive special attention.

Committee for Australian Canning Convention

A representative of the Division of Horticulture continued to act in the secretariat of the Australian Canning Convention. The 15th Convention, to have been held in September, 1969, was deferred until September, 1970; as representatives were heavily involved in industry negotiations during 1969.

Sub-Committee on Pesticides Residues in Plants and Plant Products

This Sub-Committee of the Intra-Departmental Pesticides Policy Committee reviews the pesticide residue situation in respect to plants and plant products, and recommends priorities in residues research. Investigations into residues associated with post-harvest treatments of fruit, including the chemicals thiabendazole, benomyl, 2-amino-butane and dimethoate, were given high priorities and considerable progress was made. These materials are of particular interest to the fruit industry, in respect to post-harvest control of rots and fruit fly disinfestation.

Extension Services to Fruit Industries

GENERAL

Extension Staff: Activity Statistics

Despite the extension-staff shortage (see page 69) District officers of the Division of Horticulture this year contributed to 95 field days and 267 meetings, and the preparation of 224 press articles, 12 articles for the *Agricultural Gazette of N.S.W.*, 142 radio broadcasts and 23 television programmes. They also compiled 6,498 orchard visits. A notable achievement was the publication of 21 articles by Division of Horticulture personnel in the *Agricultural Gazette of N.S.W.*

Assistance to Various Authorities

The extension services assisted a number of Government bodies, including: the Water Conservation and Irrigation Commission and the Department of Lands, in matters of closer settlement and rural reconstruction respectively; and the Electricity Commission, Postmaster General's Department, Department of Main Roads, and Local Government instrumentalities, in such matters as reporting on and assessing orchard damage allegedly due to use of hormone sprays and/or the resumption of fruit tree areas for constructional and maintenance programmes.

EXTENSION ACTIVITIES OF SPECIAL INTEREST

Citrus Industry

Tree-Planting Density.—Double planting of citrus in the tree-row has become common over the last 15 years in the Murray River districts. Management costs are not increased appreciably, compared to normal spacing, but returns per acre increase considerably—particularly in the early life of the plantings. Officers in the M.I.A. have encouraged double-planting there too, but with limited success.

An article in the May, 1970 *Agricultural Gazette* outlined the results from the 10 year old double-planting trial at Dareton Horticultural Research Station. A cost-of-production study by the Central Coast Agricultural Research and Extension Committee has indicated that even greater densities have advantages; the figures showing that with oranges the returns with 200 trees to the acre offset establishment costs in the 14th year, but in the 11th year with 400 trees to the acre. Modern irrigation methods, herbicide-management, and selected rootstocks make such tree-row densities more feasible than in the past.

Herbicide Management.—Use of herbicides as an alternative to cultivation has allowed more change in citrus culture than has any other innovation in recent times. It reduces the labour needs by eliminating many time-consuming and costly cultivations, and at the same time aids such other practices as hedgerow-culture, trickle-irrigation and platform-harvesting.

Extension officers' programmes cater for both the citrus grower for whom the method is an innovation about to be adopted and for the grower giving attention to refinements of herbicide-management.

An article ("Herbicide Management in Citrus Orchards") in the February, 1970, *Agricultural Gazette* gave an account of the results from herbicide-management trials at the Somersby, Yanco and Dareton Research Stations.

Trickle Irrigation.—Research projects have only started to evaluate trickle-irrigation in this country, but great interest in and commercial promotion of the system has required extension officers to be kept informed on world-information and to advise fruitgrowers to their limits.

A field day on trickle-irrigation sponsored by the Central Coast Agricultural Research and Extension Committee attracted a very large crowd. The system has advantages, including low capital outlay and the efficient distribution of limited supplies of water, in supplementary irrigation and in coastal orchards.

Trickle-irrigation also presents such problems as water-filtration and equipment-calibration, but the rate of adoption by growers has been rapid. Disadvantages accompanying that rate of adoption are the lack of experience generally and the high demand for materials—the latter resulting in supplies of poor-quality tubing that has very limited life and performs erratically.

Citrus Nutrition.—Results from the computerized data from analyses of leaves sampled from 150 citrus orchards over 5 consecutive years have been used as the basis of citrus nutrition field days at Griffith and Dareton and for discussion-group extension in other citrus districts. Some main topics derived from the data for these occasions were the trends in tree health as indicated by the survey, the value of leaf analyses as signposts for fertilizer recommendations, and modifications of current fertilizer practice needed to maintain tree health and productivity.

Citrus Hedging.—Mechanical hedging of citrus trees to control size has gained in importance as harvest-labour costs continue to increase. The practice has more application to hedgerow plantings, but big individual trees, normally spaced, have also been hedged in some coastal and inland orchards.

At a well-attended central coast field day, at Dooralong, citrus growers were advised on the principles of hedging. Growers were also able to compare there a hedging demonstration-area with the more conventional citrus-pruning system of skeletonizing. Since the field day there has been considerable expansion of hedging throughout the district.

The move into hedging of citrus trees has precipitated also the increased use of other aids, such as harvesting platforms to increase efficiency and reduce fatigue.

Pome Fruits Industry

Tree-Training Methods, and Planting Densities.—A programme to develop greater interest in tree-training methods has been designed. Almost as long as the industry has existed the vase-shaped tree has been used exclusively, but structurally this type of tree has disadvantages and growers are being encouraged to consider other types. Complementary to this is the encouragement of higher-density plantings; smaller and more easily managed trees. The rate and extent of adoption of this system is restricted in the short term by scarcity of suitable semi-dwarfing rootstocks.

Meantime, fruit growers are not familiar enough with the pruning methods to replace the conventional vase-type trees and are being shown the methods to enable them to handle the denser plantings. The Division has conducted demonstrations, throughout the State, to help advise the objectives.

Illustrating the trend to closer planting of pome fruit is that apple trees at Batlow over 9 years old average 87 trees/acre as against 137 trees/acre for trees between 5 and 9 years old and 165 trees/acre for trees less than 5 years old.

The Australian National Field Days, at Orange.—The District Fruit Officer at Orange organized, for the Field Days Committee, the orchard section of this annual three-day event. The main project this year was improved presentation and packing of pome fruits. The attendance of 2,300 provided many useful contacts for the Department's Fruit Packing Instructor. These, and the extension material published by him this year have helped the notable improvements in pome fruit packing and presentation.

Selection and Recommendation of Propagating Material.—Nurserymen are referred to acceptable trees for propagating material; trees selected for health and fruit type. Currently this scheme has, in 4 districts, 18 selected varieties of apples and 7 of pears.

Orchard-Management Use of Herbicides.—Management-use of herbicides has been encouraged and is now being used extensively in some districts. Officers participated in a field day at Oakdale and a meeting at Bilpin to advise pome fruit growers on such herbicide-use, and for the first time a herbicides-use section was included in the Tablelands and Coastal Highlands Spray Calendar—a publication widely received by pome fruit growers.

Stone Fruits Industry

Pruning and Tree-Training.—Promotion of long-lateral pruning of peaches through field days and individual contacts has shown growers increased production and labour-savings. Caution has been needed in the recommendations, as some growers have pruned trees too lightly and produced under-sized fruit. Adoption of long-lateral pruning is increasing in the M.I.A. The method has been in fairly common use in areas around Sydney for some years.

Market Presentation of Stone Fruit.—Need for improved market presentation continued to be emphasized by packaging demonstrations, field days, publications and orchard visits. Significant developments this year—all fostered by the Department—were the extensive use of single-layer trays for peaches, nectarines and plums, volume-filling for small and medium sized plums, and aluminium foil punnets and PVC film over-wrapping for strawberries.

The single-layer plastic trays, moulded to contain fruit in individual cups, provide marketing of stone fruit in eating-ripe condition. Volume-filling for smaller sized plums achieve savings in costs without impairing market-quality. Aluminium foil punnets for strawberries save fruit damage, and complete over-wrapping with PVC film—in conjunction with pre-cooling—increases the shelf-life.

Prune Dehydration.—To improve and standardize the quality of dried prunes, schools were held at Griffith and Young on prune dehydrator construction, operation and management. The school at Griffith was organized with the M.I.A. Irrigation Research and Extension Committee and the District Machinery Officer. At Young the school was organized with the local branch of the Australian Dried Fruits Association. Firms that supply equipment and oil for heating participated in each programme.

Soil Salinity and Drainage.—Soil salinity and drainage problems received special attention in the M.I.A. Methods to minimize the problems were publicised through the *Farmers Newsletter* and in radio and television broadcasts. A field day organized at Leeton with the Irrigation Research and Extension Committee and the Water Conservation and Irrigation Commission specialized on drainage problems.

Tropical Fruit

Post-Harvest Life of Bananas.—The results of research into use of polyethylene bags and thiabendazole to control rot-organisms, and into ethylene absorbent when packaging for distant markets, led to intensified extension work concerned with longer post-harvest life of bananas.

Banana Weevil Borer Control.—There are 2 main aspects of this extension programme: (1) the attempts in the southern banana areas, with grower co-operation, to contain and control the pest through search and treatment; and (2) the problem of resistance to dieldrin that has arisen in the northern area on the Brunswick River. Fruit officers in the banana areas have vigorously campaigned through the press and radio and television, and by demonstration; to encourage grower recognition of the pest, the damage symptoms, and any sign of insecticide-resistance.

Expansion of Minor Tropical Fruit.—Expansion of acreages of avocadoes and macadamia nuts have led to heavy demand for advice on selection of sites, propagation, culture, and management. Planted areas, though still minor in comparison to bananas, almost trebled this year. One planting of macadamia was 200 acres and there were numerous smaller areas of both avocado and macadamia.

Viticulture Industry

Soil Salting.—Although over two-thirds of the M.I.A.'s horticultural area is tile-drained, poor drainage and salt accumulation still limit grape yields. Vines, because of greater tolerance to water-logging and soil salt, tend to be the last crop to receive attention in M.I.A. orchards so far as installation of tile drains is concerned. In Murray Valley vineyards soil-salting problems are further accentuated by the more saline irrigation water, over-watering, and the topography.

An expanded extension programme was undertaken in the M.I.A. and the Murray areas, for awareness of the seriousness of soil salinity and to encourage installation of tile drains, gypsum applications, and improved irrigation practices. It is too soon to evaluate the impact of this particular programme. But part of the increased grape yield this season in these districts may be attributed to the earlier extension work on these matters.

Improved Vine Planting Material.—Awareness of the value of clones and selection of improved planting material has been created in all districts. In fact the demand for improved clones of wine grape varieties cannot yet be met. But growers and nurserymen have been advised to select cuttings from only high producing and healthy vines, and in the Lower Murray District the Fruit Officer has marked suitable source-vines in selected blocks for use by local nurserymen. Promising clones of the popular Black Shiraz and Cabernet Sauvignon varieties are being rapidly multiplied under mist-propagation to provide for future years.

Distribution of high-yielding sultana clones in the Lower Murray District has now reached under Departmental supervision the stage where all new plantings in 1971 will be of selected clonal origin. One hundred acres of clonal mother-vines have been established in the district. In the mid-Murray district, distribution of sultana clones under Departmental supervision started in 1969.

Vine Trellising for Mechanical Harvesting.—Since vines must be specially trellised and trained for mechanical harvesting, new installations must be easily adaptable to machine harvesting. Research on mechanical harvesting of grapes in Australia has intensified in 1969–70 to determine the most suitable type of machine and trellising. Meantime, growers are being informed on the developments, through field days and conferences.

The needs so far defined are that the height of the main bearing-wire should not be less than 3·75 ft, to allow passage of catching-frames, and that vine trunks must be as straight as possible.

Some machines require a wide flexible "T" trellis, and preliminary experimental results (based on production alone) have been sufficiently encouraging to advocate grower trials of this type of trellis. It is now being installed in all irrigated viticultural areas, and there have been excellent results from grower trials in the Lower Murray District.

Lighter Pruning of Non-Irrigated Wine Grapes.—Following successful adoption of lighter pruning practices in M.I.A. vineyards a demonstration plot was established on Black Shiraz vines in a non-irrigated Hunter Valley vineyard. The results showed growers that yield increases could be had by leaving more buds per vine. The techniques of lighter pruning were demonstrated at a field day in the plot and, as a result, most growers during their 1970 pruning have left more buds than usual. Pruning of non-irrigated vines was also demonstrated at a field day at Mudgee.

Drying of Vine Fruits.—As the result of programmed extension, the rack-spraying method of applying dip-solution to sultanas before drying was adopted for the 1970 harvest by 75 per cent of Murray River vine fruit producers. It gives cleaner fruit and saves labour. It was less successful with this season's tight bunches (2 to 3 sprays being needed, for adequate coverage) but because of the labour-saving advantage most will continue to accept it as a superior method of preparing sultanas for drying.

The possibility of taking rack-spraying a step further was subject of a Dareton field day. Using a CSIRO-developed technique, the fruit-bearing canes were cut at fruit maturity, the whole vine sprayed with dip-solution and the fruit allowed to dry on the vine. This procedure greatly simplifies harvesting, but the effect of premature leaf-loss on vine health may preclude general use of it.

Herbicides in Vineyards.—Use of pre-emergent herbicides in vineyards is more difficult than with citrus because the more useful herbicides can be toxic if leached into the vine root zones. Even so, some growers are successfully using herbicides in vineyards.

An extension programme on herbicidal weed-control in vineyards and encouraging trials of it was initiated in 1969–70. In the M.I.A. a television session on herbicides was presented and stimulated grower interest. In the Hunter Valley, 4 demonstration plots and 2 associated field days dealt with herbicides for undervine weed control and the control of weeds in newly planted vineyards. Most Hunter Valley growers will use herbicides next season for undervine weed control.

Fruit Packing and Market Presentation

Field Days and Demonstrations.—Besides his activities at the Orange National Field Days, the Fruit Packing Instructor co-operated with District officers to conduct 8 major fruit-packing and market-presentation demonstrations. He also addressed an International Training Course for 24 Fellows from 15 overseas countries, the Anna Bay Vegetable Growers' Association, and Inspectors (Plant Diseases Act) at an in-service training school.

Improved Fruit-Packaging.—Because of package manufacturers' keen interest, much of the Fruit Packing Instructor's time has been given to the evaluation of new packages and new packaging materials. This work included studies with apples, bananas, citrus, passionfruit, strawberries, and tomatoes. Following the work with tomatoes, the Fibreboard Development Council has been advised to manufacture only 2 types of cartons (using a higher grade fibreboard) for this commodity.

Publications.—The Fruit Packing Instructor continued very active in presenting articles for publication. Some major contributions to the *Agricultural Gazette* this year were: "Volume-fill packs for plums", "The traypack carton for apples", "Fruit handling", "Proper packing for quality fruit", and "The Market Place". He also provided an article and photographs for use in the Sydney Farm Produce Market Authority's annual report.

Fruit Industry Trends

CITRUS INDUSTRY TRENDS

Seasonal Conditions

Weather conditions generally favoured tree growth and fruit development in inland irrigation areas, though the 1969 winter and 1970 autumn were very wet in the M.I.A. and caused water-table problems on undrained properties.

In coastal districts, for the second successive year the spring weather was unfavourable and caused erratic and prolonged fruit-sets. The results have been below-average crops for this season, many crops of undersized citrus and an undesirable quantity of second-crop fruit. Hail storms in in the northern, metropolitan citrus districts caused damage and the fruit will be down-graded for blemish.

Production

The final estimate of New South Wales citrus production for 1969–70 was 6,530,000 bushels main crop, plus 300,000 summer crop lemons and 190,000 second crop Valencias; production of 7,020,000 bushels overall. This was similar to the 1968–69 production and well below that of 1967–68 (7,460,000 bushels).

The preliminary crop-forecast for 1969–70 indicates that high production from inland irrigation areas will offset below average coastal crops. There could be a production record when ultimate second-crop fruit is taken into account. The final estimate of 1969–70 production and the preliminary estimate for 1970–71 are compared hereunder:

	1969–70 Final Estimate (Bushels)	1970–71 Preliminary Estimate (Bushels)
Navels	1,500,000	1,790,000
Valencias	3,590,000	3,800,000
Commons	33,000	38,000
Sevilles	14,000	17,000
Total oranges	5,137,000	5,645,000
Lemons (winter crop)	550,000	350,000
Lemons (spring crop)	310,000	500,000
Mandarins	435,000	310,000
Grapefruit	198,000	195,000
Total main crop citrus	6,530,000	7,000,000
Plus summer-crop lemons	300,000	
And second-crop Valencias	190,000	
	7,020,000	

Citrus Maturity Standards

Pending certain amendments to the Plant Diseases Act, the final drafting of the New South Wales Citrus Grading Regulations has been delayed. The proposed new regulations introduce a ratio of soluble solids to acid, for both navels and other oranges, instead of the old acid standard. The new standards are summarized:

	Soluble Solids/ Acid Ratio	*Minimum Solids*	*Maximum Acid*
Navels	7·0 : 1	8° Brix at 20° C	1·92 anhydrous citrus
Other oranges	5·5 : 1	8° Brix at 20° C	2·24 anhydrous citrus

The Commonwealth Department of Primary Industry has adopted these standards also for export oranges. A full season's operation for local and export markets has shown the new maturity standards to be fair and reasonable.

Packaging

The N.S.W. Citrus Growers' Council continued to try on behalf of the industry to have the 4/5th bushel container gazetted as the only container for marketing citrus in New South Wales. The matter has now been referred back to the industry to resolve apparent differences of opinion on the proposal.

Citrus Export

Exports from the M.I.A. increased considerably. The 90,000 bushels of Valencias and 27,500 bushels of navels amounted to 60 per cent increase over 1968–69. On the other hand the Sunraysia district of Victoria and New South Wales, on the Murray River, could not meet negotiated sales. They exported only 119,000 bushels of Valencias and 32,500 navels; a 50 per cent reduction compared to the previous year. As previously, New South Wales supplied about 60 per cent of the fruit exported from Sunraysia through the port of Melbourne. Exports through the port of Sydney amounted (in bushels) to 80,900 oranges, 1,800 mandarins, and 6,050 lemons and grapefruit. While much of this fruit originated in Queensland, the M.I.A. largely exported through Melbourne.

POME FRUIT INDUSTRY TRENDS

Production

The 1969–70 apple crop was estimated at 3,782,716 bushels, and the pear crop at 912,581 bushels; the estimated apple crop almost 200,000 bushels less than the previous year's record crop; the pear crop, a record for New South Wales, about 200,000 bushels greater than in the previous year.

Fruit quality was reduced by widespread hail damage. Fruit size in many pear crops was below average because of the very heavy cropping and the dry pre-harvest conditions in some areas. Exceptions to these troubles were mainly in the Griffith, Leeton, and Forbes irrigated areas. These districts were virtually free from hail damage and had no fruit-size difficulties.

With 17 per cent of apple trees still non-bearing, production will continue to increase. Further increases will result from the interest in semi-dwarfing rootstocks and higher-density plantings. Pear production will also continue to increase, mainly from M.I.A. orchards—where 45 per cent of the 635 acres of Williams are still non-bearing. In fact, 15 per cent of the 2,678 acres of pears elsewhere in the State are still non-bearing.

Cool Storage

Cool storage facilities for pome fruit continued to expand. In New South Wales the total space mainly used for pome fruits is now 3,136,000 bushels. Greatest increase has been in the Orange District; now 108 cool stores there, aggregating 1,852,000 bushels capacity.

The development of controlled atmosphere (C.A.) cool storage is of special significance. Almost half a million bushels of the total pome fruit storage space in New South Wales is now of this type; 330,000 bushels of it in the Orange District. As reported earlier, Departmental research and extension have shown growers an efficient and economical means to convert existing air cool stores or parts of stores to C.A. storage. This year 10 such C.A. units have been installed.

Containerized Transport of Export Fruit

Containerization was used more extensively with apples exported this year. A good example is provided from Griffith; in 1968–69 about 3,500 bushels was exported in containers, whereas in 1969–70 about 58,000 bushels (60 per cent of the export apples) was shipped in containers. From Leeton all (though only 14,400 bushels) was shipped as container cargo.

Apple Processing, as Cider

A likely significant development was the establishment of cider manufacturing at Campbelltown. The product has been well promoted. It has alcoholic content of about 5 per cent. The company is at present processing imported concentrated apple juice (from cider apples) and locally produced concentrate, but proposed to install crushing equipment and encourage growers to plant cider varieties.

Specific cider varieties are not grown in Australia but there is a nucleus of propagating material at research stations in several States. This Department is collecting cider varieties interstate and has also introduced 5 of the best overseas varieties (at present in quarantine).

STONE FRUIT INDUSTRY TRENDS

Canning Fruits Production and Plantings

Yields of canning apricots and peaches were affected both by tree-deaths and removals during the wet winter of 1969, and by the unfavourable blossoming period—through frosts and brown rot blossom-blighting. The total apricot crop was 4,101 tons (3,663 tons to canneries), as against crops of 6,504 tons in 1968–69, 4,384 tons in 1967–68, and 9,371 tons in 1966–67. The peach crop, 16,589 tons, though slightly better than the 1968–69 crop of 15,850 tons, was less than 80 per cent of the 1967–68 crop (21,086 tons), and the 1966–67 crop (21,284 tons).

In the M.I.A., almost 400 acres of peaches were removed between November, 1968 and November, 1969. Most were water-damaged trees, or old trees of unsatisfactory varieties. Less than 100 acres were replanted in the same period as replacements. Apricot removals were almost 100 acres; with little replanting. However, there is now renewed interest in replanting peaches and apricots. All available trees have been ordered from nurserymen.

Prune Production and Plantings

Heavy crops of good quality prunes were produced in the M.I.A. but crops at Young were reduced by unfavourable weather during blossoming and later by hail storms. Final figures for dried prunes are not yet available but total New South Wales production will approximate 4,000 tons. The M.I.A. crop has been estimated at 2,200 tons; only slightly less than in 1967, the year of maximum production. Production at Young is likely to approximate 1,600 tons; slightly less than in the previous year and only two-thirds of the 1967 crop.

Most of the Robe de Sergeant prunes produced were diverted to other outlets; from the Young district 235 tons were sold for jam processing and about 8,000 half-bushel cases (about 100 tons) on the fresh-fruit market. Lesser quantities were diverted from the M.I.A. to these channels.

Rate of replanting of prunes has increased at Young. The area of d'Agen prunes has slightly increased in the M.I.A., but not enough to offset reduced acreage of Robes.

Mechanical Prune-Harvesting

Major developments occurred in the mechanization of prune harvesting. Four modern whole-tree shakers operated in the M.I.A. and two at Young. Also in the M.I.A., mechanical shaking was used in association with bulk handling methods. Increase in dehydrator-capacity in producing areas is a need if full advantage of mechanical harvesting is to be taken.

Dessert Peach Production and Presentation

Peach crops were very variable. Overall production was less than normal, due to unfavourable spring weather and scattered hail storms. Estimates of production are difficult as the dessert crop is produced in scattered areas and marketed through numerous channels.

With marked increase in the use of single-layer tray packs, the fruit was generally marketed at a more advanced stage of maturity but reached the consumer in excellent condition.

Some tree losses occurred from wet conditions. New South Wales statistics show a decrease, from 4,800 acres to 4,400 acres, between December, 1968 and December, 1969. Fifteen per cent of the trees are non-bearing; insufficient to maintain bearing-areas.

Nectarine Production and Area

Crops were very light and quality fruit met high prices. Nectarine area has declined from 500 acres in 1965 to 450 acres in 1969.

Plum Production and Area

Crops of European plums in inland districts were very light and coastal crops of Japanese varieties were variable. Total area of plums has decreased slightly over recent years but the new plantings should be sufficient to maintain existing areas.

Acceptance of volume-filling for small and medium sized plums has reduced marketing costs, while single-layer packs of large quality-fruit have met excellent prices.

Cherry Production and Plantings

Crops are again increasing at Young, following the setback from tree losses in the 1968 drought. The District marketed 174,800 one-quarter bushel cases even though more than 20,000 cases was lost through rain-splitting and brown rot during the harvest.

Wet conditions in October and early November reduced the set of crops at Orange. A few growers harvested reasonable quantities, but yields from many orchards were very low. Only 120 tons was delivered to the cherry brinery for processing.

Plantings increased in all cherry Districts. Enough rootstock trees were planted at Young to fully replace losses of trees during 1968. Considerable new areas have been planted at Orange and Armidale. Plantings have also slightly increased at Lakesland near Picton.

Interest is being shown in the production of cherries for brining. The Shepparton Preserving Company of Victoria initiated action to establish a processing plant at Orange. Although it was found necessary to discontinue the venture late in the year, increased quantities of processed cherries (mostly imported from Italy) are being utilized by canneries for cocktail mixtures. Average annual production of brined cherries in Australia approximates 300 tons, but a market exists for about 2,000 tons.

STRAWBERRY INDUSTRY TRENDS

Excellent crops of good quality fruit were produced and prices remained high throughout the season. Estimates placed production at above 1,200,000 punnets. Some growers produced crops of over 15 tons/acre.

An estimated 70 acres of new plantings in the autumn almost doubled that of the previous year. Increase was restricted only by plant-availability. Trickle-irrigation has been installed in a considerable proportion of the new areas.

General adoption of aluminium-foil punnets has improved the market presentation of the crop. Some growers have been completely over-wrapping fruit in aluminium punnets with PVC film. This practice has resulted in greater shelf-life of the product.

NUT INDUSTRY TRENDS

Pecan and Walnut

Interest in development of pecan growing in the State has been shown by overseas concerns.

In a development near Moree a large area has been levelled for planting pecans, and further areas are being cleared. In a nursery area, 16,000 pecan seedlings have been budded. Seedlings which should be ready for budding in 1971 have been raised in another area.

Other interests have enquired concerning the availability of land and resources for walnuts.

Macadamia

Two large new plantings of macadamia on the Richmond River occupy some 260 acres. Plantings of this size allow full use of mechanization for cultural practices and ultimately for harvesting. Fruit Officers have been closely associated with this development; assisting with propagating methods, plantation layout and management advice.

TROPICAL FRUIT INDUSTRY TRENDS

Banana Production

To southern markets, including the M.I.A. and Perth, consignments through the Banana Growers' Federation Co-op. Ltd transport system totalled 3,595,860 bushels. These were in some 3,816,000 packages (about 3,100,000 bushel cases packed in singles, 700,000 cartons and 16,000 dump cases packed in hands—the latter consigned to the M.I.A.). Direct sales to Brisbane, Wollongong, and Canberra, and through such other outlets as the country-order and retail trade totalled some 300,000 bushels.

Thus, the total produced and marketed in 1969–70 was 3,895,860 bushels; 300,389 more than in the previous year. The Perth market absorbed over 114,000 bushels in 1969–70, as against 69,000 in the previous year. The increase was because of severe cyclone damage at Carnarvon, Western Australia.

In most locations plantations had recovered slowly but well from the 1968–69 drought. Rainfall, though 10 inches below average for the year, had been well distributed. After above-average rainfall in May, 1969, all crops entered the 1969 winter with plenty of soil moisture available. Production climbed during late spring, reached an early peak in December, 1969, and levelled out at over 400,000 packages per month for the 5 months including April, 1970.

The State's marketed production was from 21,181 acres of bearing bananas, providing an improved production average of 184 bushels/acre. Coffs Harbour area again had the highest productivity with 209 bushels/acre. The increased productivity in each district was outcome of better seasonal conditions and the better management that reflected an improved economic situation in the industry. But the marketing quota system imposed by the Banana Growers' Federation during the December–April high-production period is also reflected in the "marketed production" total of 3,895,860 bushels. A figure for *actual* production would have been 40 per cent higher.

Banana Acreage and Varieties

The total acreage in New South Wales at 1st April, 1970, was 22,528. This was 168 acres less than in the previous year. Even so, some 25 more growers entered the industry, making a total of 2,792 growing one acre or more; whereas the total growing less than one acre decreased by 82 to 4,003. New plantings totalled 1,424 acres, but 1,748 acres were destroyed.

Dwarf Cavendish variety again decreased in area, to 2,072 acres, and the dominant Williams variety decreased by 167 to 20,304 acres.

Banana Containers

The industry continued to examine new containers, with accent on larger wooden cases suitable for "hands"—to give greater net weight of fruit. The fibreboard carton to contain 35 lb net weight of "hands", although approved by the industry, has not yet replaced the 30 lb net unit.

Although use of fibreboard cartons for "hands" packs has increased by 4 per cent to a record 41 per cent of total packages consigned from Coffs Harbour, other Districts have not shown the same acceptance. The Tweed and Brunswick Districts consigned 19 per cent of the total packages as cartons, and the Richmond a much lower proportion.

Aerial Control of Banana Leaf Diseases

The number of growers who adopted aerial spraying to control Sigatoka disease (leaf spot) in 1969–70 increased dramatically. A record 4,650 acres were so treated (18 per cent of the New South Wales banana acreage). All Districts except the Richmond reported big increases in aerial spraying. At Yarrahappinni 48 per cent of the area was so treated.

Resultant Sigatoka control has been very satisfactory in most areas, but for leaf speckle control the method is open to question because of the physical difficulty of depositing the fungicide on the undersurface of leaves.

Banana Marketing Control

The Banana Industry Act, and Regulations under the Act, were proclaimed on 3rd October, 1969. After a poll of banana growers, a proclamation was made in May, 1970, constituting the Banana Marketing Control Committee. The Committee comprises the Board of Directors of the Banana Growers' Federation Co-op. Ltd, together with a nominated public servant and a consumer representative. The Committee will examine new marketing proposals. Its first meeting is expected to be in July, 1970.

At mid-summer, 1969–70, when high production threatened the economic return, the Banana Growers' Federation applied a "quota system" by refusing transport of a percentage of each grower's fruit. This relieved the market and was generally well-received by growers.

Banana Export Proposals

To help solve the marketing situation the industry is examining the possibility of developing an export outlet to Japan. The Department has co-operated in preparation of small trial shipments. Several small delegations from Japan have visited the banana areas for discussions.

Australian participation has been encouraged by the lifting of quarantine restrictions caused by presence of Queensland fruit fly in the production area. But restrictions on use of fungicides, e.g. thiabendazole, will prevent successful export at this time.

Banana Weevil Borer

Two main problems facing the industry in relation to banana weevil borer (*Cosmopolites sordidus*) are: the developed resistance to dieldrin, in the Brunswick area; and the increase in number of infestations, in the southern area at Coffs Harbour and on the Nambucca.

The resistance problem is being examined on high priority by the Entomology Branch. The other problem is subject of a "survey, contain, and control" programme directed by an industry committee and Departmental officers.

Trends of Other Tropical Fruit

Pineapples.—A 1969–70 survey of pineapple plantings showed that acreage had decreased on the northern rivers. Growers have been discouraged from extended plantings; by closure of the cannery at Ballina which had processed most of the crop. Growers on the Richmond are examining the possibility of establishing a new cannery, at Lismore, to salvage the pineapple and associated processing activities.

Avocadoes.—Avocado acreage in all Districts has increased. It now totals almost 300 acres. Growers, appreciating the need to organize this developing industry, have formed an Avocado Advisory Committee under the aegis of the Banana Growers' Federation. A New South Wales Avocado Growers Association is also being constituted; to encourage research into avocado problems, and to establish the industry and the marketing on a sound basis.

Passionfruit.—The acreage increased slightly in all Districts. The State total is now 716 acres; the highest for years. Presentation and packaging of the fresh fruit have been improved by using fibreboard cartons into which fruit is volume-filled after a wax dip.

In the Metropolitan-Hills-Gosford areas, seedling plantings are still predominant. On the north coast, most recent plantings have been of the hybrids 3–1 and 3–26 on *P. edulis f. flavicarpa* rootstock. The hybrids outyield seedlings but have shown relatively high susceptibility to the woodiness virus in these areas.

Planting is unlikely to extend in the north unless processors are able to offer firm contracts, as much of this year's main crop was refused by Brisbane canners. The canners had adequate supplies from Queensland growers and New Guinea.

Miscellaneous Tropicals.—Because of the fluctuating economy of the banana industry, many growers are exploring the possibility of commercial production of some of the lesser known fruits such as litchi nut, Chinese gooseberry, custard apple, and mango. At present the rate of availability of suitable types for New South Wales conditions is limiting the trial plantings by intending growers, but some nucleus-plantings of litchi nut and Chinese gooseberry have been made.

VITICULTURAL INDUSTRY TRENDS

Increasing Wine Grape Production

Consistent with the trend since 1961, of increasing production of wine grapes in New South Wales, the State's 1970 vintage has been estimated as a record 67,000 tons. The previous record, 54,313 tons, was harvested in 1969.

Because of the excellent season, substantial areas of young vines entering production, and improved technology, the M.I.A. vintage was 53,577 tons; an increase of 25 per cent over the previous year's record crop of 43,210 tons. Overall yield average increased from 7·4 to 8·9 tons per acre.

Of the more important varieties in the M.I.A.: Doradillo averaged 10·3 tons/acre, followed by Semillon at 9·8, White Shiraz at 9·4, Palomino at 9·3, Ulliade at 8·5, Grenache at 8·3 and Black Shiraz and Gordo Blanco at 8·2 tons/acre. To supplement their needs, M.I.A. wine-makers introduced 310 tons from the Coleambally Irrigation Area and 5,339 tons of drying varieties of vine-fruit from Murray River Districts in both New South Wales and Victoria.

The heavy crops, and associated cool conditions, delayed fruit maturity. But because of intense competition between wineries for grapes, especially for dry reds, wineries accepted grapes at lower than normal maturity levels and the vintage was not delayed.

In the Hunter Valley, despite downy mildew incidence and hail losses in the Muswellbrook area, good rainfall promoted production of an estimated 2,500 tons of wine grapes; as against 1,625 tons harvested in 1969. Excellent crops (2 to 3 tons per acre) were grown where downy mildew was controlled, and in some vineyards yields were twice as high as in 1969. Fruit quality was good, and quality of the wine is expected to be excellent.

Substantial quantities of lower Murray and mid-Murray Districts' Sultana and Gordo Blanco grapes were diverted to wineries for production of distillation wine, to overcome the wine industry's general shortage of fortifying spirit. Some 9,000 tons of fruit from New South Wales and Victoria growers was processed in Murray River District wineries established only in the past 2 years. At Corowa, 420 tons of grapes were harvested; as against the very light 1969 crop of 94 tons. Production at Barooga was 1,100 tons of wine grape varieties.

Increased Wine Grape Plantings

Increasing consumption of table wines has ensured a keen, continuing interest in developing new vineyards and expanding existing vineyards. During 1968 and 1969 some 3,622 acres were planted to wine grapes, bringing to 12,827 acres the total area of wine grape plantings in New South Wales. Most of the new plantings comprised table wine varieties.

Major gains have been: in the M.I.A., an increase from 5,833 in 1967 to 7,380 acres in 1969; in the Hunter Valley, from 1,760 to 3,350 acres in 1969; and in the lower Murray River District, from 409 in 1967 to 752 acres in 1969. Production has also been supplemented by some diversion of drying-varieties to wineries, but not on the same scale as has occurred in South Australia.

At its 1970 annual meeting the M.I.A. Wine Grape Planting Advisory Committee decided there was need for further plantings of Black Shiraz and Gordo Blanco, with limited plantings of Grenache, Palomino, Frontignac, White Shiraz, and premium varieties. Data presented to the Committee have shown that M.I.A. production could reach 65,000 tons by 1972 if the 1970 yield levels are maintained.

Rate of planting in the M.I.A. is expected to decline in 1970 as the area of land available for new plantings becomes a limiting factor. But in the rapidly expanding Hunter Valley area the reliable indications are that at least another 2,500 acres will be planted to wine grapes in 1970, followed by further heavy plantings in the 1971 and 1972 planting seasons.

As many of the new vineyards in the Hunter Valley will be supplementary-irrigated, yield average will be well in excess of the present 1·5 tons/acre. Conceivably, by 1976 the production of wine grapes from this area will reach 20,000 tons and will reach 100,000 tons for the whole of New South Wales.

Most of the new Hunter Valley vineyard developments are on a large scale (up to 1,600 acres) and being financed by city investors and public companies. But landholders in other areas have shown considerable interest in wine grape growing as means of diversifying their enterprise(s). Small plantings have already been made in such areas as Coonabarabran, Wee Waa, Cowra, and Inverell and could later be the basis of substantial new wine industry.

The recent years large plantings throughout Australia have caused concern over the possibility of over-production in the wine industry. A Commonwealth Grape Advisory Committee is being formed to collate planting and production statistics for all Australia, and to suggest courses of action that may be needed—to avoid overproduction. A third "term of reference" for the Committee concerns work towards a stabilization scheme for the wine industry.

Trends in Wine Grape Prices

In the M.I.A., wine grape prices increased by an average of $4 per ton. Prices paid per ton were: Black Shiraz $82, Semillon $70, White Shiraz $57, Grenache $59, Doradillo $52, and Palomino $57. Prices paid for Murray River sultanas were variable, ranging from $38 to $54 per ton, and caused concern to grape grower organizations seeking price uniformity and stability. In the Hunter Valley prices were high; in excess of $300 per ton for fruit produced in the traditional Pokolbin area.

Table Grape Trends

The area planted to table grape varieties in New South Wales declined to 2,753 acres in 1969, because of greater interest in wine grape varieties. But local markets were kept well supplied, by diversion of drying varieties to the fresh-fruit market.

Variable Table Grape Production

Table-grape yields were variable, throughout the State. Production was below normal in the Campbelltown District because of downy mildew and rain damage.

The substantial quantities of sultanas forwarded to the Sydney markets from the Murray River Districts in New South Wales, Victoria, and South Australia are dominating the market and limiting the scope for table-grape growing in New South Wales. Heavy crops and cool conditions delayed maturity of the Murray River fruit and several large consignments—failing to meet maturity requirements—were rejected from the markets.

The poor out-turn of Ohanez grapes exported to the Philippines last season through Melbourne, from Murray River Districts, reduced the demand for similar exports this season. Therefore large quantities of Ohanez were diverted to domestic markets. These adversely affected market returns for the late-maturing fruit from the Orange District.

There was, however, good demand for export fruit—including Ohanez from the M.I.A.—shipped through Sydney; 14,956 half-bushel cases were exported. The largest consignments were to the Philippines. These were sterilized in transit, by low temperature, to meet with the Philippines' quarantine requirements.

Most of the 14,956 cases exported were half-bushel cases, indicating a strong trend away from the formerly standard two-third bushel case. Packing as individually wrapped bunches rather than in cork was also widely used.

In the M.I.A., production for table-grape marketing continued to decline as greater quantities of the varieties were delivered to wineries. Only 113,239 half-bushel cases of table-grapes were marketed from the M.I.A.

Dried Vine Fruit Trends

Record Production.—Dried vine fruit production in New South Wales for 1970 is estimated at a record 14,900 tons; as against the low crop (8,257 tons) in 1969 and the previous record crop (14,751 tons) in 1967. The estimated 14,900 tons for 1970 would comprise 13,506 tons of sultanas, 868 tons of raisins and 562 tons of currants.

Because of the heavy crop and cool season, fruit maturity was delayed. Drying conditions overall were poor, so turnover of racks was slow and this impeded the harvest. In consequence, fruit harvested towards the end of the drying season required dehydration. The problem was most severe in the mid-Murray District. There, 60 per cent of the fruit harvested needed additional dehydration by packing sheds.

Acreage.—The area planted to dried vine fruit varieties in New South Wales was 9,687 acres at December, 1969. New plantings have averaged 177 acres per annum for the past 3 years, sufficient only to maintain the present acreage. However, because of increasing use of selected clones and nematode-resistant rootstocks, the production average is expected to increase as the new plantings come into bearing.

Commonwealth Stabilization Plan Rejected.—The first 5-year plan ended with the sale of the 1968–69 crop. The new Stabilization Plan was announced by the Minister for Primary Industry in September, 1969 and accepted by the Board of Management of the Australian Dried Fruit Association (A.D.F.A.), but in February, 1970 the Plan was rejected in a referendum of growers. A majority of the growers who voted favoured adoption of the plan, but because a big section of growers did not cast votes the number of votes in favour did not reach the required majority.

The A.D.F.A. proposes to re-open discussions on a Stabilization Plan if a survey of Branches indicates that most growers in fact favour the proposal.

Moves by growers that a single Commonwealth Statutory Board be set up to acquire and market all dried fruits in Australia and overseas were opposed by the A.D.F.A.

Export Trade.—Australia asked for an increase of $75 a ton on the International Sultana Agreement minimum world-price. This was refused by Greece and Turkey. A compromise resulted in $15 a ton increase in the minimum price.

Final dried-fruits tonnages of sultanas, currants, and raisins exported from the 1968 crop were announced by the Australian Dried Fruit Control Board in August. Total figures exported were: sultanas 53,157 tons, currants, 3,761 tons, seeded raisins 3,476 tons, and unseeded raisins 78 tons. United Kingdom, Canada, and the Continent were the biggest buyers. The Control Board announced that the low 1969 crop would be supplied to overseas markets on a quota system so that the interest of some markets would not be lost.

A large proportion of the 1969 crop was moved to overseas buyers in containerized shipping. Most of the 1970 crop is expected to be exported likewise.

The International Sultana Agreement has agreed to the early marketing of 7,000 tons of the 1970 Australian sultana crop in the U.K. and on the Continent; a decision confined to the 1970 crop.

Regulatory Services by Division of Horticulture

LEGISLATION

Plant Diseases Act

Further progress has been made in reviewing legislation under the Plant Diseases Act, including the Act itself. Cabinet approved strengthening of the sections dealing with grade standards for the marketing of fruit and vegetables; to provide for revised inspectional procedures. New regulations and proclamations gazetted during the year were: (a) Amendment to Regulation 43—Tomato grades and packing; (b) New Regulations 38, 39, and 40—Banana grades and packing; (c) New Regulation 50—Miscellaneous fruits packing; (d) Proclamation declaring tangors and tangelos to be "fruit"; (e) Proclamation restricting entry of fruit and plants from Victoria (re *Sclerotinia laxa*); (f) Proclamation prohibiting the entry of grape vines into certain shires in the Hunter Valley; (g) Proclamation re destruction of certain infested bananas at Bowraville.

New regulations providing for the marketing and packaging of citrus fruits and potatoes have been drafted. These will be gazetted following amendments to the Act.

Fruit Cases Act

A new Act to replace the outmoded Fruit Cases Act is in the initial stages of drafting. Incorporation of the fruit and vegetable grading and packaging powers contained in the Plant Diseases Act, and the regulating powers of the Fruit Cases Act, into a new Fruit and Vegetable Marketing and Packaging Act, are proposed.

Horticultural Stock and Nurseries Act

The preliminary draft of regulations and proclamations has been started. The draft will be submitted to the nursery industry for consideration.

Banana Industry Act

A proclamation was gazetted to provide for a poll of banana growers to decide whether a Banana Marketing Control Committee be constituted under the Act. At the poll the majority voted in favour. A proclamation was issued on 22nd May, 1970, providing for constitution of the Committee and the first meeting is expected to be held in July, 1970.

Potato Growers Licensing Act

The total of potato growers licenses issued this year was 1,058.

PROSECUTIONS AND WARNINGS

Eighteen persons were prosecuted during the year. The range of offences were: *Market offences:* failure to remove old brands, 1; failure to brand, 7; misdescription of grade, 1; excessive size variation, 2; topping, 4; dry oranges, 1. *Pest and disease:* failure to control fruit fly, 1; breach of M.I.A. quarantine, 6; breach of Regulation 28, Plant Diseases Act, 1.

In addition, the following informations were lodged in court and await hearing: Market offences—failure to remove old brands, 1; and failure to brand, 2; breach of M.I.A. quarantine, 2; failure to control fruit fly, 1; failure to comply with Regulation 28, Plant Diseases Act, 1.

Four informations for marketing offences and 2 for failure to comply with Regulation 28 of the Plant Diseases Act are being prepared for lodgement in court. Forty consignments (1,830 packages) of immature grapes were seized at the Sydney markets. Twenty-two letters of warning were sent, mainly for marketing offences.

FRUIT FLY CAMPAIGN

Queensland fruit fly was more prevalent than normal in those parts of the State where this pest is now endemic. Isolated outbreaks also occurred at Narrandera and Deniliquin, thus causing some restrictions on fruit exports. Immediate action to suppress these outbreaks appears to have been successful.

Of the 55 towns participating to various extents in the *Whole-Town Treatment Scheme*, 36 were apparently free from fruit infestation, 8 had very light to light infestation, 6 had moderate and 5 had heavy infestation. Fruit infestation mainly occurred late in the season, and in towns in the northwest. Once again there the evidence was definite that the whole-town treatments, properly applied, have suppressed Queensland fruit fly. But despite treatment, in a few towns the degree of infestation was higher than it should have been. Additional regulatory action is being programmed for these towns in the coming season.

Towns that newly joined the whole-town treatment scheme (the treatments being applied by local Government authorities and, in some cases, contributions being made by local organizations) were: Baradine, Binnaway, Coonabarabran, Gilgandra, Wauchope, Warren. In the following towns bait-spraying was added to the measures already being taken: Balranald, Barham, Deniliquin, Koraleigh, Mathoura-Moama, Moulamein, Wakool.

Interceptions of fruit fly infested fruit at the Euston Road Block totalled 44, the same total as in 1968–69.

OTHER PEST AND DISEASE INCIDENCE WORK

Citrus

Red scale, a major problem in inland citrus areas in 1968–69, was largely brought under control. Some spraying was delayed by weather but the control measures generally gave good results. *Soft Brown and Citricola scale* built up to high levels on some properties in the Sunraysia area during January. *White wax scale* was more prevalent than normal on coastal citrus, mostly due to unfavourable (wet) spraying weather in January. Other coastal pests more prevalent than normal were *White Louse scale* and *Blossom Bugs;* while inland, on the Murray and Murrumbidgee Rivers, *snails* were a problem.

Incidence, coastal, of *Black Spot* and of *Melanose* was greater than normal. The wet winter in the M.I.A. caused a rise in water tables and the loss of some trees through *Phytophthora. Greasy spot* fungus was observed in the lower Murray irrigation areas, a result of relatively humid and unusually mild conditions. *Sudden Death* of trees on trifoliata rootstock was a problem on some Gosford orchards; three growers lost up to 15 per cent of particular plantings. Lemon plantings in Gosford district suffered severe leaf fall, seemingly due to combined effects of *Phytophthora* activity, magnesium deficiency and the very heavy main crop.

Stone Fruit

Twig infections and blossom blighting by the *Brown rot* fungus were fairly heavy early in the season. Cherry crops at Orange and Armidale and early cherries at Young were also severely damaged by this fungus during harvest. *Peach Leaf Curl* caused severe damage where bud-swell sprays were delayed. Fresh *Bacterial Canker* infections were very prevalent in cherries, particularly at Orange. At Young, also, that disease caused more damage than usual.

There was a general build-up of *San Jose Scale* infestations in stone fruit throughout the State; attributed in part to difficulties in applying normal preventive sprays during the 1969 winter and spring. Growers in general are aware of the increased incidence and have prepared to make the necessary spray applications this year. *Green Peach Aphids* were more than usually difficult to control. There were reports of increased damage to blossoms and fruit by *Carpophilus beetles* in orchard plantings in the Hills districts. *Two-Spotted Mite* was difficult to control when carbaryl sprays had to be applied to control oriental peach tip moth.

Flying Foxes continued to damage fruit crops in the Hills and Kurrajong districts, and minor damage was reported from the M.I.A. and other areas. *Mice* also caused some damage to peach and prune crops in the M.I.A.

Pome Fruit

No disease caused major losses. The most notable was *Apple Scab;* difficult to control on the central and northern tablelands during the wet spring. The only other disease of concern was *Powdery Mildew*. This was more prevalent where insufficient time had been spent on the pruning of mildew-susceptible varieties.

The disorder *Bitter Pit*, cause of some concern in apples exported from New South Wales in recent years, was not serious except in the Campbelltown district. Calcium nitrate spray designed to reduce losses from bitter pit was widely used.

The most troublesome insect was *Two Spotted Mite;* the most difficult to control. Satisfactory pesticides are available but the difficulty lies in adequate tree-penetration and distribution of chemicals by the extensively used automatic types of spray machinery. Conditions favoured the pest's build up during the warm dry December–February period and it became prevalent then, and later in the season, in almost all districts. *San Jose Scale* can generally be controlled satisfactorily but there were indications of trouble from this pest—mainly on the northern tablelands. A survey is being conducted there because normal control procedures do not seem to be achieving the expected results. Spread of this pest was suspected also at Orange, and it was very troublesome in the M.I.A.

Bananas

In association with the Entomology Branch, and assisted by the banana industry, a survey is being conducted to determine the extent of resistance of *Banana Weevil Borer* to dieldrin. So far, 652 acres have been found with resistant borers present; involving 46 growers. These are all within the Mullumbimby District. New infestations by the borer were found at Coffs Harbour, involving 28 plantations and 269 acres; and at Macksville, involving 10 plantations and 54 acres. One heavily infested neglected plantation near Macksville was destroyed. Widespread infestations have also been found in the town of Port Macquarie.

In previous years, *Corky Scab* was mainly of concern on bunches thrown in December. This year its incidence extended throughout the year, although tapering to very low levels during mid to late summer. With the maturity of December–January bunches in April–June it again reached serious levels and caused concern. With the unusually warm winter, carryover of *Red Spider* on bananas through the winter was heavy, and populations rose sharply in the spring and summer. Many growers applied dimethoate and demeton-S-methyl from the air, mixed with the misting oil. Immediate knockdowns were excellent, but populations built up again. In some areas tetradifon seemed to give better results than dimethoate.

The number of *Bunchy Top* infected banana plants detected (633) showed a marked decrease on the previous year (1,416). The Tweed District continued to be the main area affected; 522 in 1970, as against 1,279 in 1969. *Sigatoka*, the disease previously known locally as *Cercospora leaf spot*, started early and continued through the year. Infection was severe where growers did not apply adequate control measures. As mentioned earlier, aerial spraying to control it increased considerably.

Marasmius disease, observed around the base of banana plants for many years, has increased in severity and distribution. A spring survey of 2,341 acres in the Murwillumbah District showed 1,074 acres apparently free, 856 acres lightly infected, 281 acres moderately and 130 acres heavily infected. Some predisposing factors that may be associated with the increase have been recorded for examination.

Leaf Speckle was very damaging during mid to late summer where fungicide sprays were not applied. Thiabendazole dips for control of *Black-end* and *Squirter* came into use this year, with good results.

Other Tropical Fruits

Passionfruit.—Brown Spot on the north coast caused substantial losses where control measures were not regularly applied. *Woodiness* or *Bullet Virus* symptoms were widespread in the supposedly tolerant hybrid 3–26. *Crown Rot* caused loss of some vines worked on *Passiflora flavicarpa* rootstocks. The *Fruit Spotting Bug* appeared more prevalent than usual, causing losses to passionfruit (and avocadoes). The *Scarlet Mite* caused damage to passionfruit vines at Numulgi; the only previous record of it attacking passionfruit was at Nambucca in 1963.

Avocado.—Monolepta Beetle invaded avocado orchards on the north coast. Carbaryl proved to be probably the most effective insecticide used to avoid the use of organochlorines. *Anthracnose* was a problem in avocadoes; the variety Rincon particularly prone to it.

Grapes

Conditions in the Hunter Valley and Campbelltown districts in November favoured *Downy Mildew;* most growers persevered with the fungicidal sprays, and overall crop losses were relatively small.

The vine virus disease *Leaf Roll*, now known to be severely present in M.I.A. and Murray River vineyards, is spread by propagation. Growers and nurserymen have been encouraged by District Fruit Officers to propagate only from vines which do not display *Leaf Roll* symptoms. Vines with minimum leaf roll have been located and marked. Cuttings from source vines known to be free of leaf roll, and high yielding, are being rapidly propagated in glasshouses for establishment in plantings as a future source of first class material.

Because of the occurrence in South Australia of a vine disease known as "*Dying Arm*", the introduction of grape vine cuttings or rootlings into New South Wales from South Australia is prohibited. A thorough search of vineyards in New South Wales during 1969–70 did not reveal vines showing typical symptoms of "*Dying Arm*". Others that could be closely related to "*Dying Arm*" were present.

Mealy Bug, difficult to control, was on sultana vines in Murray River districts and table varieties in the M.I.A. Heavy *Bunch Mite* infestations were found, in most districts, where growers had not applied adequate control measures. *Elephant Beetle* larvae burrowing in the wood of vines was serious in the Hunter Valley and the Campbelltown Districts.

Stored Products and Grain Pests

Further surveys in respect to the occurrence of maldison-resistance in the rust red flour beetle *Tribolium castaneum* did not reveal presence of a resistance-problem outside the original locations, recorded in 1968–69. The position in respect to other grain and stored product pests is also being examined.

SYDNEY MARKET INSPECTIONS

Fruit—Quality and Supplies

Apples.—Improved quality and presentation of apples marketed from June to September were evident. The fruit was in good supply. Apples genuinely C.A.-stored, reaching the market from September to December, had good quality and brought high prices. Fruit reputed to be C.A.-stored, including some from interstate, were cutting black by December, and there was breakdown in Jonathans in October. Quality of apples from ordinary cool stores started to fall away in October.

Early-apple supplies from local districts were moderate and quality was generally good. But some showed extensive hail damage. Queensland apples were lighter in supply, and mostly sold slowly due to poor quality. Moderate supplies of apples continued, with further evidence of hail damage.

Pears.—Supplies were fair from June to September. Some good quality pears, packed in polythene bags, were marketed into November. Heavy supplies of new season pears showed widespread hail damage, and an increase of "good grade" was evident. Down-grading was regular. Demand for blemished and small sized fruit was poor.

Stone Fruit.—Early-, mid-, and late-district cherries were in light supply. Most lines showed hail and weather damage; breakdown was extensive, and demand poor. Early apricots were in light supply and quality was poor, due to weather damage; Menindee apricots met a good demand; apricots from the M.I.A. were of fair quality. A light supply of peaches and plums came from early-districts; plums sold well; peaches were wasty, and some heavy losses occurred. Mid-season and late peaches were in moderate supply; sizes were good; a further increase in the use of trays resulted in good prices Nectarines were in short supply throughout the season; quality was only fair, due to weather damage. Improved presentation, with use of trays, brought good prices for the large better-quality fruit.

Grapes.—Queensland grapes reached the market in December; quality was good; most were accompanied by a maturity-test certificate. Heavy supplies of Murray Valley and M.I.A. grapes started early in the new year; testing for maturity led to seizure of some lines; quality and supply decreased as the season progressed, due to rain damage. Coastal grapes were well presented and good quality. Western district grapes, reaching the markets late in the season, were good quality, well presented, and keenly demanded.

Oranges.—Navels from the 1969 season, in moderate supply, barely bridged the gap until the Queensland and M.I.A. Valencias started in moderate supply. Coastal Valencias were in good supply. Testing for maturity and juice content were conducted continuously. Dryness did not become a problem. Dead red scale blemish was extensive on late consignments of M.I.A. Valencias.

Other Citrus.—Supplies of lemons were moderate throughout the season; freshly picked, good quality lemons met keen demand; stored or stale fruit were wasty and sold slowly. Queensland Meyers tended to waste. Mandarins were in good suply from Queensland; quality and presentation were generally superior to local mandarins; most of the latter were small and blemished lines. Demand for grapefruit was keen, for the supplies available; imports from the U.S.A. and Israel helped to bridge the gap; the Israel fruit was of only average quality and waste was extensive.

Bananas.—Quality and presentation were average; mixed-ripe was a problem in the autumn; and some Queensland bananas were heat-affected in December–January. Size-grading was good; except in the period of spring when prices were high—and some regulatory action was taken in this period. During the period June to November banana supplies from New South Wales areas decreased, while Queensland supplies increased; during December to May both New South Wales and Queensland supplies increased.

Other Tropical Fruit.—Supplies of good quality *pineapples* were moderate to light. There was little blister or breakdown, compared to past years; packaging was good, and well received. *Custard apples* were in light supply but good quality. *Avocadoes* were well presented in single layer cartons; demand was strong; the supplies moderate to light. Supplies of *mangoes* were moderate. More cartons are being used for mangoes. Supplies of good quality *papaws* were moderate. Good quality *passionfruit* were in moderate supply; mostly from Queensland and the north coast; prices were low at times.

Strawberries.—Supplies were good throughout the year; from New South Wales, Queensland, Victoria, and New Zealand. Packing and presentation were good.

Vegetables—Quality and Supplies

Tomatoes.—Moderate to light supplies were received. The Queensland areas of Bowen, Redland Bay, and Bundaberg were the main suppliers in winter and early spring, though Bowen production was drastically reduced by drought. Queensland central coast assumed a new importance as a supplier to Sydney. New South Wales north coast areas are extending their production periods into the cooler weather. Metropolitan area glasshouse crops continued to decline in importance; in favour of early central coast field crops, the north coast, and supplementary consignments from South Australia. Quality overall was good. Regulatory action was usually only for mechanical damage and poor sizing. There were faulty labellings and failures to remove old brands in local consignments.

Potatoes.—Approximately 1,027,650 bags were received; about 32,400 bags less than 1969. Overall rejections increased by 19,860 bags compared to the previous season. Late blight was of no concern. Potato moth was not as severe as in previous years. Some Queensland potatoes were heat-affected and 10,491 bags were downgraded for this reason—the greatest total for many years.

Other Vegetables.—Moderate to heavy supplies of fair quality *peas* were received. Some lines were very hard to clear; usually canning varieties, which had been allowed to fill right out. *French beans* were in moderate to light supply; quality only fair. Weather damage was evident in some Gosford and north coast lines. Queensland beans had suffered from lack of water.

Moderate to heavy supplies of *capsicum*, *succhini*, and *egg plant* came mainly from Queensland in the latter half of 1969, and then from local growers. Quality of the northern produce was excellent, but humid weather toward the end of the season caused heavy wastage. Local growers continue to grow these vegetables as late summer and autumn crops; for capsicum and zucchini especially, the supplies and quality now available in Sydney are excellent all year round.

Major supplies of good quality *celery* came from Victoria, from late January, and South Australia from mid-March. Local supplies continued in the spring; quality was excellent.

Castaway Certificates

The Certificates issued involved 1,463 consignments, totalling 22,333 packages of produce.

EXPORT INSPECTIONS. FOR THE COMMONWEALTH DEPARTMENT

Fresh fruit and vegetables, seeds, wheat flour, etc., submitted for export from New South Wales were examined on behalf of the Commonwealth Department of Primary Industry under provisions of the Commerce (Trade Descriptions) Act. Container shipments of New South Wales fruit were forwarded from Mildura, Leeton, and Griffith as well as Sydney.

Export Permits Issued

Export Permits Issued.—For fruit, 1,658 Export Permits were issued; for vegetables, 1,717; for flour, 725; for wheat, 163; and for other commodities, 191; a total of 4,454.

Export Permits (General).—Export Permits were issued also for 12,776 packages as follow: pasture seed, 6,185; bird seed, 369; field peas, 962; vegetable seed, 2,814; tree seed, 765; nuts, 462; cereal seed, 1,219.

Export Inspections—Fruit and Vegetables

Apples.—142,665 bushel cases and cartons of apples were shipped from the port of Sydney, 20,000 more than in the previous year. The total included 12,221 bushels from other States. Of these, 2,510 came from Queensland; compared with 34,536 in the previous year. About 75 per cent went to the U.K. and Europe (10,620 to Germany). Most of the remainder went to South East Asian and Pacific island destinations.

Quality of the fruit was good. Main New South Wales sources of supply were the M.I.A., northern tablelands, Batlow, Orange, and Forbes. Rejections totalled 2,960 bushels. The main reasons were bitter pit, broken skins, bruising, San Jose scale and (where precooling was required for shipment under refrigeration) core temperatures exceeding 45° F.

Pears.—The quantity shipped totalled 33,169 cases (previous year 12,572 cases). Two shipments totalling 5,972 cases were sent to the U.S.A. and subjected to in-transit low-temperature sterilization. Main destinations were South East Asia and the Pacific islands.

Oranges.—80,881 bushels were exported; almost the same as the previous year. Most were shipped to South East Asia, and a small percentage to the Pacific islands.

Other Citrus.—1,798 bushels of mandarins (about one third of the previous year's total) went to South East Asia and the Pacific islands. Lemon and grapefruit shipments totalling 6,048 bushels went to Pacific island destinations.

Grapes.—The shipments totalled 14,956 cases (mostly $\frac{1}{2}$ bushel); at least 1,500 cases more than in the previous year. Most went to the Philippines, and were subject of in-transit low-temperature sterilization. The rest went to Pacific island destinations.

Stone Fruits.—26,356 cases (an increase of about 3,500) of peaches, plums, apricots, cherries, and nectarines were shipped, mostly to Pacific island destinations.

Strawberries and Tomatoes.—These totalled 1,196 cartons and 21,275 boxes respectively, much the same as in the previous year, and were to Pacific islands.

Miscellaneous Fruits.—Mostly small private consignments. Six hundred and three packages were forwarded principally to Asiatic and Pacific island destinations.

Vegetables.—118,859 packages were exported; almost 8,000 fewer than last year's total. Rejections were heavy, mainly due to soil not being completely cleaned off but some were because of insect infestations.

Export Inspections—Grains and Flour

Wheat.—Exports increased by 653,734 tons on the previous year. Inspections were regular throughout the year at the Sydney and Newcastle Grain Elevator Terminals. A statistical summary is:

	Sydney	Newcastle	Total
Wheat ship surveys	106	70	176
Wheat ships rejected at survey	15	20	35
Tons of bulk wheat loaded	1,872,918	688,878	2,561,796
Tons of bulk wheat rejected	5,690	870	6,560
Tons of bagged wheat loaded	9,799	1,392	11,191
Tons of bagged wheat rejected	110	....	110

Flour.—97,867 tons of flour were shipped, an increase of 8,661 tons on the previous year. Eighty-five bags were rejected, for main damage. General standard of export packaging was good and branding was satisfactory. The year saw the start of containerization of flour exports. This method is permitted at approved premises only. Container shipments were forwarded from Narrabri and Tocumwal, as well as Sydney.

Rice.—Exports increased by about 4,500 to 81,055 tons; mainly to New Guinea and the Pacific islands.

Export Inspections—General

International Health Certificates.—5,822 such certificates were issued, dealing with 149,781 packages containing such items as small quantities of seed, nursery stock, cut flowers, small packages of fruit, etc. These goods do not require an Export Permit.

QUARANTINE

Intra-State Quarantine Inspections

Hunter Valley Grape Industry.—With rapid expansion of grape plantings in the Hunter Valley, the industry became concerned at the possibility of introduction of further pests and diseases. For further protection against this, a proclamation has been gazetted prohibiting the entry of grape vines and cuttings into the Shires of Merriwa, Scone, Patrick Plains, Denman, City of Greater Cessnock, City of Maitland, Municipalities of Singleton and Muswellbrook, and part of the Shire of Dungog.

M.I.A.—The Murrumbidgee Irrigation Areas quarantine restrictions have been under review by local fruit grower organizations, with a view to securing extension of the quarantine boundary to include Narrandera. Occurrence of a minor outbreak of fruit fly in that town, and the effect on M.I.A. exports, encouraged this move. But there is opposition from Narrandera residents.

Amendments to the proclamation imposing the M.I.A. quarantine restrictions are being made to permit the controlled entry of certain fruits following post-harvest disinfection treatments.

Six prosecutions for quarantine breaches were conducted. Several others are part heard or pending.

Banana Districts.—Banana bunchy top and weevil borer control and eradication campaigns were continued within the banana quarantine area with the help of the Banana Growers' Federation. As indicated earlier, the total of bunchy top detections declined appreciably compared to last year's.

A total of 118 notices were issued to growers to comply with Regulations 28 or 29; 1 prosecution was conducted; 3 prosecutions are pending; 2 others are under consideration. One neglected and infested plantation was destroyed.

Commonwealth Quarantine Inspections

Continued growth in volume of overseas trade transacted through New South Wales ports, and the development of containerization, have increased the implementation problems of plant quarantine. Despite the rapid growth of container shipments of general cargo (totalling about 1 million tons for the year) the cargo tonnage handled by conventional shipping did not reduce correspondingly. There was in fact a substantial increase in the number of conventional ships serviced by quarantine.

Figures released by the Maritime Services Board revealed that for Sydney, the normal 6–8 per cent annual increase in general cargo grew to a 19 per cent increase for 1969–70. While increased exports contributed to this growth, imports also played a major part. The impact on quarantine activities is indicated by the 24 per cent increase in the number of quarantine permits issued (from 41,700, last year, to 51,781).

Opening of the new International Terminal at Kingsford Smith Airport, and the continued rapidly increasing volume of incoming passengers, combined with the objective of more rapid customs- and quarantine-clearance, have placed further strains on the staff situation.

Seed Examinations.—Of 425 samples submitted to the Department's Seed Testing Laboratory, 100 contravened 1 or several provisions of the Quarantine Act. Of the 100 contravening samples, 55 contained prohibited weed seeds, 52 contained excessive quantities of restricted-crop seeds, and 30 contained excessive quantities of earth.

The laboratory hand-cleaned 43 packets of seed (trade and experimental samples) and 5 portions of small lines, to facilitate release. Some 50 specimens, of suspect origin, were extracted from the samples and forwarded to the Biology, Entomology or Botany laboratories for identification and comment.

Nursery Stock.—The quantity of imported nursery stock showed an increase of 1,865 plants over the previous year. A total of 14,518 plants were held under the Nursery Stock Regulations. These included 5,548 orchids, 1,475 cacti and succulents, 3,385 ornamentals, 566 aquatic plants, 1,000 bulbs, 371 grape vine cuttings, 1,718 rose budding eyes, 186 sugar cane cuttings, 12 mangoes, 15 bananas and 106 potato tubers. Initial inspections revealed little disease or pest incidence; except mites, aphids and ants. But post-entry examinations during the growing season revealed some instances of disease; requiring destruction of the plants.

Parcel Post.—Examination of goods and articles arriving by Parcels Post at the Sydney Mail Exchange, and subject to Quarantine regulations, continued throughout the year. A total of 11,659 parcels and packages were withheld for examination; 1,654 of the packages were detained for further examination, treatment or destruction.

Overseas Passenger Vessels.—245 overseas passenger and naval vessels were attended on arrival, for inspection of articles brought to attention by Customs officers. Large quantities of goods were held for treatment or destruction.

General Wharf Inspections.—1,307 overseas ships were visited, to inspect goods requiring a Quarantine Permit before release; an increase of 276 ships on the previous year. Items inspected included coffee, cocoa, copra, dates, legumes, peanuts, other nuts, pasture seed, motor vehicles, all cargo from India, Pakistan and Ceylon, cotton, all rattan and bamboo ware, etc.

Imported motor vehicles totalled 26,735, an increase of 3,549 on the previous year. Of the total, 3,169 were second hand and 1,336 required steam cleaning for removal of soil. Of the new cars, 1,533 were quarantined for soil contamination.

Bean seed (*Phaseolus*) imported for processing, and released after treatment, totalled 22,219 sacks. Due to weakness of bags, their spillage contaminated much general cargo; cleaning had to be done under supervision. Some 2,327 sacks of unrestricted beans (comprising broad beans and tick beans) were imported.

Presence of foreign seeds necessitated that 769 sacks of various spice seeds be cleaned or ground under supervision.

Some 21,041 cartons of citrus fruits were imported (15,166 cartons of grapefruit from the U.S.A.; 4,675 of grapefruit from Israel; 1,200 of oranges from the U.S.A.) and 14,977 bags of onions were imported from New Zealand.

To comply with Custom (Narcotics) requirements, 481 bags of poppy seed (opium) identified were devitalized.

Copra (446,738 bags) was quarantined and processed under supervision, and the bags heat-treated.

Safflower, linseed and peanut imports were processed under supervision; 4,042 tons safflower, 3,930 tons linseed, from South Africa, and 109,820 sacks of peanuts from Mexico, Brazil, India, Africa, New Guinea and Asian countries. Some 11,531 sacks of peanuts were fumigated for insect infestation before release for processing. From 185,764 sacks of soybean meal imported there was, in every shipment, a great deal of spillage because of bags breaking open.

A total of 117,127 packages of unrestricted nuts were inspected (walnuts, cashews, almonds and brazil nuts) and 14,946 cases containing cashew nuts infected with borers were fumigated.

Jute waste (1,356 bales) was heat treated for cereal straw contamination.

Pasture seed, mainly from New Zealand and the U.S.A., totalled 35,672 sacks; of this total, 403 sacks were cleaned of foreign seeds and released, and 638 sacks of Berseem Clover were returned to the country of origin after unsuccessful recleaning.

Some 23,400 bales of cotton were processed under quarantine control. All bagging and droppings were subjected to further processing or were destroyed under supervision.

Supervision of Treatments.—Supervision of treatments at approved premises was constant; involving fumigation, heat treatment, unpacking, destruction, steam cleaning of goods, and cleaning of seed not passing quarantine inspection.

Inspection of Premises.—This involved inspection of cotton, peanut and copra processing plants, and check inspection of bond stores. There was also regular inspection of goods at approved premises and inspection of cars at approved commercial importers' premises.

Cases and Pallets.—The Sydney waterfront was continually manned by 3 Inspectors, each responsible for a section; to inspect packing cases, pallets and packing materials.

Containerization.—The number of container vessels regularly arriving at the Port of Sydney increased to 15, from 2 in the previous year. These comprised 9 from U.K.-Europe, 5 from Japan, and 1 from New Zealand. Also, the number of containers arriving on conventional vessels notably increased. Vessels carrying containers only will be still more numerous within the next 6 months; with introduction of at least another 8 on the U.K.-Europe service.

This year 44,946 containers were landed at the Port of Sydney; 268 of these were quarantined for soil contamination.

The staff wholly employed on containers are: 1 Inspector at each of the 3 container depots, 1 Inspector on container manifests at Export and Import Branch, and 1 mobile Inspector—supplemental as necessary—covering the waterfront.

Timber.—Import of timber into New South Wales totalled 201,000,000 super feet; 20 per cent less than last year. The quarantined total was 3,830,000 super feet. Strikes in the lumber industry in North America accounted for a drop of 40 per cent in importations of Douglas Fir. Imports from some other countries were slightly above normal.

South East Asia remained the main source of infested timber. Nearly 4 per cent (about 1¼ million super feet) of sawn timber from there was quarantined and treated. Other timber quarantined was ½ million super feet of Philippine mahogany, 9,200 super feet of taun from New Guinea and 1½ million super feet of logs from South East Asia.

There were several interceptions of Sirex wasp in case wood. All cases were destroyed immediately.

This was the worst year for carpenter ant interceptions. Fifteen ships, all from the U.S.A., carrying these ants in dunnage had infected holds fogged. The dunnage was either fumigated or destroyed.

Kingsford Smith Air Terminal.—The flights from overseas into this Airport increased to 7,505, against 6,693 in the previous year; and overseas passengers increased to 716,168, as against 603,870. Items held and forwarded to Export and Import Branch for decision decreased to 405, from 540. Prohibited goods intercepted and abandoned (including fruit, vegetables, seeds, plants, etc.) decreased from 273 bags (30 lb) to 242 bags. They were destroyed. The number of bond inspections increased to 1,959, from 1,676, and included perishables such as berry fruits from New Zealand.

Richmond RAAF Base.—Flights from overseas into Richmond increased to 525, from 423 in the previous year. Passengers increased to 5,896, from 2,779. Cargo decreased from 19,895,000 lb in the previous year, to 11,371,000 lb this year. Goods quarantined included pallets, cases, curios, fruit, etc. The U.S.A.F. parcel-post yielded the usual restricted items requiring treatment or destruction.

Personal Effects.—Inspections by appointment totalled 1,560 this year, an increase of 471 compared to the previous year. The total of pieces quarantined was 3,480. Of these, 2,455 cartons and cases contained baskets with rice straw concealed in the handles.

INSPECTION STATISTICS—NEW SOUTH WALES PORTS

Exports Inspections	1967–68	1968–69	1969–70
Fruit and Vegetables:			
Apples	66,262 bushels	122,407 bushels	142,665 bushels
Pears	17,585 cases	12,572 cases	33,169 cases
Oranges	104,898 bushels	81,218 bushels	80,881 bushels
Mandarins	3,074 bushels	4,904 bushels	1,798 bushels
Grapefruit	1,967 bushels	1,068 bushels	2,199 bushels
Lemons	1,866 bushels	1,355 bushels	3,849 bushels
Apricots	2,931 packages	1,949 packages	1,427 packages
Peaches	10,630 packages	13,581 packages	12,323 packages
Plums	6,377 packages	4,795 packages	8,419 packages
Cherries	6,923 ¼-cases	4,567 ¼-cases	5,818 ¼-cases
Nectarines	1,547 packages	1,464 packages	1,911 packages
Grapes	22,875 cases	13,346 cases	14,956 cases
Tomatoes	39,305 cases	21,025 cases	21,275 cases
Vegetables	122,139 packages	126,414 packages	118,859 packages
Strawberries	....	1,094 cartons	1,196 cartons
Grain and Flour:			
Wheat—bulk	2,555,374 tons	1,915,420 tons	2,561,796 tons
Wheat rejections	79,000 tons	6,238 tons	6,560 tons
Wheat—bagged	2,600 tons	3,833 tons	11,191 tons
Flour	105,415 tons	89,206 tons	97,867 tons
Rice	96,723 tons	76,610 tons	81,055 tons

Quarantine (Imports) Inspections	1967–68	1968–69	1969–70
Nursery stock	11,380 plants	12,653 plants	14,518 plants
Parcel post—packets detained for examination	10,157 packets	10,394 packets	11,659 packets
Parcels detained for treatment, etc.	1,236 packets	1,541 packets	1,654 packets
Overseas flights—Mascot	5,833	6,693	7,505
Overseas passengers—Mascot	434,830	603,870	716,168
Overseas bond inspections	..	1,676	1,959
Overseas flights—Richmond	351	423	525
Overseas passengers—Richmond	2,800	2,779	5,896
Overseas freight—Richmond	17,725,000 lb	19,895,000 lb	11,371,000 lb
Overseas vessels inspected	..	1,031	1,307
Passenger ships	272	268	245
Inspections Personal effects—appointments	1,942	1,089	1,560
Timber	216,000,000 su. ft	252,000,000 su. ft	201,000,000 su. ft
Timber quarantined	5,344,000 su. ft	4,500,000 su. ft	3,830,000 su. ft
Beans (Phaseolus) processing	..	20,146 bags	22,219 bags
Soybean meal	..	34,718 bags	185,764 bags
Motor vehicles (new)	..	21,080	23,566
Motor vehicles (new) requiring treatment	..	1,379	1,533
Motor vehicles (second hand)	..	2,106	3,169
Motor vehicles (second hand) requiring treatment	..	979	1,336
Quarantine permits issued	36,000	41,700	51,781

DIVISION OF ANIMAL INDUSTRY

General

PROFESSIONAL STAFF

Obituary

Dr M. Lindtner, Veterinary Research Officer, senior poultry pathologist for 14 years at the Veterinary Research Station, Glenfield was accidentally killed in Europe. At this time Dr Lindtner was visiting research centres before attending the World Veterinary Poultry Conference in Yugoslavia, where he was to present a paper and chair a session.

Retirements

Dr R. N. McCulloch, Director of Cattle Tick Research, and Mr J. A. Hobbins, Inspector-in-Charge, West of Mungindi Section, Queensland Border, retired.

Special Appointments (Additional Duties)

Divisional Chief Mr R. A. Hall was appointed to the part-time position of Deputy Chairman of the Meat Industry Authority set up under the Meat Industry Authority Act. Mr Hall and Principal Veterinary Officer Mr D. G. Christie were appointed members of the Artificial Breeding Board established under the Dairy Industry Authority Act.

Vacancies

The net situation at 30th June, 1970, after various appointments, resignations, and retirements during the year, was as follows: 3 Veterinary Research Officer positions, 2 Livestock Research Officer positions, 1 Research Officer position, 5 Veterinary Officer positions, 1 Livestock Officer (Pigs), 1 Livestock Officer (Poultry), and 1 Livestock Officer (Apiculture) positions were vacant.

Advanced Degrees

The following officers were awarded advanced degrees: Livestock Research Officer Mr E. S. Batterham (M.Rur.Sc.; University of New England); Livestock Research Officer Dr I. D. Killeen (Ph.D.; University of Sydney); Research Officer Dr J. Nolan (Ph.D.; Cornell University, U.S.A.); Livestock Research Officer Dr A. K. Sheridan (Ph.D.; University of Sydney); and 9 other officers were on study leave, for the whole or a part of the year, aimed at higher degrees.

Officers Overseas

The following officers were overseas for the whole or a part of the year: District Veterinary Officer Mr R. B. Bonner, studying for the Diploma in Animal Health at University of London; Veterinary Research Officer Mr M. G. Campbell, in New Zealand to study liver fluke in sheep; District Veterinary Officer Mr R. C. Denyer, in Indonesia and Thailand to study exotic diseases; Principal Livestock Officer (Sheep and Wool) Mr R. D. Eastoe, in India to organize the mutton breeding project under the Colombo Plan; Veterinary Research Officer Mr C. A. W. Jackson, studying at the Houghton Poultry Research Station, United Kingdom; Veterinary Research Officer Dr M. Lindtner visited Europe to investigate poultry research and attend the World Veterinary Poultry Conference, and tragically died in Europe; Livestock Research Officer Mr B. J. McGuirk, studying at the University at Edinburgh; Livestock Officer (Poultry) Mr P. J. McMahon, in New Zealand to study poultry husbandry; Research Officer Dr J. Nolan, studying at Cornell University, U.S.A.; District Veterinary Officer Mr D. J. Walker, in Indonesia and Thailand to study exotic diseases; and Livestock Research Officer Mr B. R. Wilson, studying at the University of Alberta, Canada.

NEW BUILDINGS

At the Veterinary Research Station, Glenfield, completed extensions to the Parasite Laboratory added to the facilities for liver fluke research. The Drought Feeding Laboratory and associated Animal House (funds provided by the Australian Meat Research Committee) were almost completed. Improvements were also made to the Research Station's main entrance and a new parking area was constructed.

At the Board of Tick Control Laboratory, Lismore, additions were completed and occupied.

Livestock Health—Field Activities

REGULATORY DISEASE CONTROL

Tail-tag Identification of Cattle

Stock Diseases Act Regulations provided means for compulsory identification (with limited exceptions) of cattle either sold or consigned to slaughtering establishments; a plastic tail-tag bearing a registered number for the property of origin. Thus, when carcasses are found affected with disease at slaughter, the property from which the cattle came is identified. The scheme was particularly directed against tuberculosis and brucellosis. But it also enables advice to owners in respect of other infections, notably hydatids.

Owners had to apply to their Pastures Protection Board for a registered number and supply of tags. Despite many months of publicity, initially there was widespread non-compliance. This necessitated warning letters. After several months of operation only isolated breaches were apparent.

Restrictions of Pig Movements

Regulations introduced in 1961, when an outbreak of swine fever occurred, prohibited the sale of pigs in public saleyards other than for immediate slaughter at abattoirs and approved slaughterhouses. Pigs for restocking could be bought only direct from other farms. These restrictions continued after the successful eradication of swine fever, and have remained in force to prevent the spread of other diseases—especially salmonellosis, necrotic enteritis and pneumonia. Field evidence and the reduced percentage of carcass-condemnations for septicaemia show the success of the restrictions.

Tuberculosis (*Cattle*)

Protected Area Scheme.—The 82 tuberculosis Quarantine Areas were changed to 18 Protected Areas; to enable particular properties within Areas to be declared as quarantine areas. Such properties were then in quarantine until the herds had passed two negative tests. While in quarantine, only cattle going to slaughter could be moved from the property, except in special cases—when cattle to be moved out could be kept separate from the rest of the herd and given two consecutive tests. Cattle introduced to Protected Areas had to be tested before entry.

Protected Areas comprised the whole of New South Wales coastal plains. Routine herd-tests were done mostly by approved practicing-veterinarians, at Government expense, but in some remote areas were done by Departmental Veterinary Officers. The latter also did retests of herds necessitated by detection of reactors.

Cattle tested totalled 700,151; a slight increase on the previous year's 684,969 tested. Reactors comprised 0·077 per cent of the cattle tested; similar to the previous year's 0·08 per cent and the lowest incidence since the Scheme started in 1960. The total requiring retest because of detection of reactors declined to 34,271, from 42,592 in the previous year.

Tuberculosis lesions were not found in 45·6 per cent of reactors; a slight rise on the previous year's 41·5 per cent. However, "no visible lesion" reactors comprised 0·035 per cent of cattle tested; similar to the previous year's 0·032 per cent.

Statistics of testing under the Scheme are summarized in this table:

Administrative district	Purpose of test	Cattle tested	Reactors		"No visible lesion" (NVL) Reactors	
			Number	Per cent	Number	Per cent
Central	Routine ..	183,319	32	0·017	16	50·0
	Retests ..	8,371	49	0·59	18	40·8
Cumberland	Routine ..	126,351	155	0·12	44	28·4
	Retests ..	11,823	86	0·73	54	62·8
North East	Routine ..	250,325	85	0·034	42	49·4
	Retests ..	14,043	109	0·77	58	53·2
South East	Routine ..	33,960	1	0·003	1	100·0
	Retests ..	34	....	....	....	....
Totals	Routine ..	593,955	273	0·046	103	37·7
	Retests ..	34,271	244	0·71	130	53·3
	Introductions ..	71,925	23	0·032	13	56·5
Grand Totals		700,151	540	0·077	246	45·6

The single intradermal test, done in the caudal fold, was the usual method; read at the 96th hour in most cases but at the 72nd hour in some problem herds.

In one herd, a long series of retests was needed because of the continuous detection of reactors; 5 reactors were detected at the sixth test. In another herd, reactors have continued to occur over 11 years; feeding stalls are thought responsible for transmitting infection. The short thermal test was sometimes used as a check method.

To close a possible avenue of tuberculosis spread, consignment of reactors to saleyards for sale to abattoir operators was discontinued; all reactors were thereafter consigned direct to abattoirs.

After the tail-tag identification system of cattle consigned for slaughter was introduced, 58 infected carcasses within Protected Areas were traced to the herds they came from. Twenty-seven such herds were tested and 8 of these showed further infection.

Because of the big total of tuberculosis specimens being submitted, to the Veterinary Research Station, Glenfield the methods of diagnosis were modified. Auramine 0 fluorescent stain was used on smears of all fresh material. It proved more accurate than acid-fast stains, and speedier. Specimens negative on smear-examination were submitted for histopathology. Also, auromine 0 stains were done on tissue sections. All bovine cultures isolated were *Mycobacterium bovis*.

TB Control Outside Protected Areas.—In the control of tuberculosis outside Quarantine Areas, 59,601 cattle were tested and 1,035 were positive. Herds found to be infected were quarantined, and testing was continued until 2 negative herd-tests had been obtained. Trace-back of 79 infected carcasses from abattoirs, through tail-tag identification, was effected. Forty-two of the herds concerned were tested, and reactors were detected in 19.

This year the policy of testing cattle brought into New South Wales from known infected herds in other States was introduced.

Tubercule-free Herd Scheme.—Under this voluntary Scheme of accreditation, 46 herds comprising 8,428 cattle were tested. There were 4 reactors. A further 26 herds accredited during the previous year, for 2 years, were not tested.

Tubercle-free Milk Schemes.—These Schemes involve herds from which milk is sold unpasteurized. There has been progressively-less cattle tested under these schemes; reflecting the lessening quantity of milk sold unpasteurized.

One Scheme, applying to the larger cities, was administered by the New South Wales Milk Board (replaced at the end of the year by the New South Wales Dairy Industry Authority). Nineteen herds (8,677 cattle) were tested. There were 4 reactors.

Municipal and Shire Councils supervised the other Scheme. It operates in small cities and towns. Testing was done in 15 areas. Tested cattle totalled 1,930 and all were negative.

Tuberculosis (*Pigs*)

Three herds were placed in quarantine for tuberculosis, while one previously quarantined was released. Control is based on sanitation. Progress is determined by the TB-incidence in pigs consigned for slaughter. All pig-strains of *Mycobacterium spp.* identified were Runyan group III (including *M. avium* serotype II and *M. intracellulare* serotype VI).

Pigs given the tuberculin test totalled 940, and 57 reacted.

Tuberculosis (*Poultry*)

Tuberculosis was detected in 19 flocks. These were placed in quarantine. Control was by sanitation. Quarantine was also maintained on 19 flocks found infected before this year started. Twenty-five flocks were released.

Brucellosis (*Cattle*)

Projected "Brucellosis Control Programme".—Plans were finalized to implement, in the next financial year, Phase I of a Brucellosis Control Programme based on the recommendations of the National Sub-Committee for Control of Tuberculosis and Brucellosis.

Phase I will comprise the compulsory vaccination of female calves between 3 and 6 months of age. Within Tuberculosis Protected Areas, comprising the coastal and dairying section of the State, all calves will be so vaccinated—at Government expense. This Phase will continue until infection level has been so reduced that test and slaughter can be applied.

The vaccination is to be done by practising veterinarians approved for this work, but where these are not available it will be done by Departmental veterinary personnel.

Regulations have been gazetted under the Stock Disease Act, restricting strain 19 use to calves between 3 and 6 months old. For older stock, strain 45/20 vaccine has been approved for use in particular herds—at the discretion of the District Veterinary Officer.

To identify vaccinated stock a 3-hole ear-punch is to be used. For 3 to 6 months old calves vaccinated, the punch is to be inserted in the left ear; for calves older than 6 months vaccinated with strain 19, in the right ear. When strain 45/20 is used, the insertion is in the right ear on the occasion of the first injection; in the left ear at the second.

Outside Protected Areas, the vaccinated programme will apply only to known-infected herds. To assist their recognition, random testing of cattle at slaughter is to be done and the source of positive reactors traced by the tail-tags. Infected herds are to be quarantined, although movement of cattle on or off such properties will not be restricted.

Brucellosis Incidence Survey.—The survey into brucellosis incidence in various parts of the State, started some 2 years earlier, was continued in 5 districts. Of the 4,187 blood samples collected at abattoirs for the serum agglutination test, 263 reacted while 262 were inconclusive. At dairy factories, of 7,982 samples given the milk ring test some 3,297 reacted while 569 were inconclusive. Of 2,701 cream samples tested, 933 were positive.

In addition to those testings, a further 18,932 samples were tested for diagnostic purposes, interstate and overseas movement, and sale. Of the 18,932 samples, 1,711 reacted while 1,256 were inconclusive.

Voluntary Brucellosis-free Herd Scheme.—This was continued. Six herds were accredited.

Interesting Cases.—From the stomach of an aborted foetus an organism similar to *Brucella abortus* strain 19 was isolated. The whole dairy herd had been vaccinated with strain 19 vaccine the previous year.

The complement fixation (C.F.) test proved useful in distinguishing from those caused by natural infection, high titres to the serum agglutination test due to strain 19 vaccination.

Use of the C.F. test in a herd which had been vaccinated as adults enabled brucellosis to be eradicated with the loss of a few animals.

Brucellosis (*Pigs*)

No Incidence.—This was not encountered this year. Four pigs that reacted to the serum agglutination test were found to be free of infection. Some 763 pigs were tested for this disease.

Voluntary Brucellosis-free Herd Scheme.—This was maintained. Twenty herds were accredited.

Anthrax

Only 17 outbreaks occurred; significantly fewer than the 31 in the previous year. All were in the recognized anthrax belt, in the west of the State. Deaths totalled 489 sheep, 9 cattle, and 9 pigs. On one property 60 cattle were penicillin-injected after the death of 6; no more died.

Stock vaccinated totalled 220,529, on 217 properties; comparable with the previous year's 211,354, on 223 properties. The policy of summer quarantine of stock reserves whereon there was anthrax in the previous 5 years was again implemented. The 10 stock routes quarantined last year were again quarantined; their use was restricted to stock vaccinated against anthrax or transported by motor vehicle.

Regulations were amended to provide that unless authorized by permit, stock must not be moved from a holding in the 14 days after vaccination. Previously, quarantine was imposed for this period. A new form was brought into use for notification of vaccinations by licensed inoculators.

Pleuro-pneumonia Contagiosa (*Cattle*)

No outbreak occurred. Four cattle destroyed as possibly infected were found, on necropsy, free of the disease. In one line of ex-Queensland cattle tested for entry into the South Eastern Protected Area, the one reactor to the complement fixation test was negative on retest.

A proclamation was gazetted under the Stock Diseases Act prohibiting entry into New South Wales of any cattle which, during the preceding six months, have been in an area proclaimed as an infected or quarantine area. A policy change also dispensed with need for a test before entry into either of the two Protected Areas, in the case of cattle introduced from Queensland and which—during the preceding 6 months—have been continuously within the South Eastern Queensland Protected Area.

Some 6,164 cattle were tested, mainly for movement and export needs. The C.F. test was also applied for survey purposes to 19,113 serum samples received at the Veterinary Research Station, Glenfield.

Johne's Disease

Three cases occurred on a far south coast property where there had been a long history of the disease. Two were bulls. One of these died after 6 weeks diarrhoea. The other was destroyed. The third was a cow; dam of a bull found infected 2 years ago. At that time, the cow was thrice tested with negative results.

Footrot (*Sheep*)

New England Protected Area.—This year the Armidale Quarantine Area was re-gazetted as the New England Protected Area and enlarged to include a further part of the Tamworth Pastures Protection District and part of the Upper Hunter Pastures Protection District. The change to Protected Area enabled included individual properties to be declared quarantine areas and the conditions for control of the disease thereon to be prescribed.

At the start of the year 6 properties in the Area were known to be affected. During the year 22 more were recorded; some of these because of enlargement of the Area. Other causes were: local spread; infected sheep brought from the south where the disease is enzootic; and, in some flocks, reappearance after years of dormancy.

The summer conditions particularly favoured spread of infection but, pleasingly, the disease did not appear in the many flocks where eradication measures had previously been effected.

Of the 6 flocks affected at the start of the year, and the 22 new outbreaks, 16 were still infected at the close of the 12 months. In the 16 were 3 where infection remained for the whole year. Eradication was deemed successful in 12 of the 28 flocks. The methods respectively were: hoof paring and formalin foot-bathing in 2 flocks; treatment, with disposal of obstinate cases, in 8 flocks; disposal of all infected and in-contact sheep in the case of the 2 other flocks in the 12.

Elsewhere in the State.—It was a bad, virulent-footrot year. Many flocks were affected, particularly in the spring. Interest was widespread in the new method recommended by the CSIRO to control acute outbreaks; a walk-through foot-bathing, without hoof paring. The method appeared successful in the field.

Some owners who had planned summer-months eradication measures deferred their action, following CSIRO announcement of development of a successful vaccine.

Cattle were considered the source of the causal organism in one outbreak affecting sheep.

Pullorum Disease (*Poultry*)

The Testing Schemes.—Testing continued under the *Voluntary Accredited-flock Scheme*, and the *Compulsory Testing Scheme* for flocks from which hatching-eggs or chickens less than 3 weeks old are sold. Field-testing was normally by the rapid whole-blood test. In special cases sera were sent to the Veterinary Research Station, Glenfield for the agglutination test. A summary of this testing is set out in the following table:

Scheme	Flocks	Birds	Positive		Doubtful	
			Number	Per cent	Number	Per cent
Accredited flocks—						
Sydney area . .	63	533,466	300	0·062	520	0·097
Country areas . .	13	298,262	3,566	1·195	1,207	0·4
Totals	76	831,728	3,896	0·47	1,727	0·21
Compulsory testing—						
Sydney area . .	26	58,193	102	0·18	77	0·13
Country areas . .	8	14,966	48	0·32	25	0·17
Totals	34	73,159	150	0·2	102	0·14

In Accredited Flocks in Sydney area the total reactors remained low, but detection of high incidence of reactors in 2 flocks in country areas led to a rise from 0·16 per cent to 0·47 per cent in overall incidence of reactors in the Accredited Flocks Scheme. One country flock accounted for over 3,000 positive reactors. The total of flocks accredited increased slightly; from 73 to 76.

In Compulsory Test flocks the total of reactors fell from 0·06 per cent to 0·2 per cent. The total of flocks involved in compulsory testing fell from 50 to 34; reflecting the trend to fewer but larger flocks.

Isolates.—Culture-examination of 461 reactors from 77 consignments of fowls sent to the Veterinary Research Station, Glenfield, yielded 3 isolations of *Salmonella pullorum* and 1 isolation of *Salmonella typhimurium*. This compares with 18 isolations of *S. pullorum* and 6 isolations of *S. typhimurium* from 77 consignments in 1968–69. Cultural examination of 51 consignments of dead-in-shell embryos comprising 161 batches of eggs yielded 2 isolations of *S. pullorum* and none of *S. typhimurium*. This compares with 8 isolations of *S. pullorum* in 1968–69.

Revocations of Authority to Test.—The authority of a practising veterinarian as an approved tester, and 2 of his employees as authorized testers, were revoked. Continued failure to report the results of pullorum testing was the reason.

Infectious Laryngotracheitis (*Poultry*)

Vaccination Policy-change.—The regulation restricting to registered veterinarians the vaccination of poultry against infectious laryngotracheitis was repealed. Thus vaccination may be done by any person. This policy change reflected the advent of avirulent vaccines, the development of eye-drop vaccination, and a relative fall in number of veterinarians servicing the poultry industry.

Trichomoniasis (*Cattle*)

Trichomonas foetus was not detected in any herd. On completion of the eradication programme, quarantine restrictions were removed from a herd found infected in the previous year.

External Parasites (*Sheep*)

Statistics.—The following table shows the relevant statistics of properties and sheep quarantined because of sheep lice (*Damalinia ovis*) and sheep ked (*Melophagus ovinus*):

	Lice		Ked		Lice and Ked	
	Sheep	Holdings	Sheep	Holdings	Sheep	Holdings
Central	6,677	7	....	....	....	....
Central West	100,370	89	195	2	506	2
Cumberland	3,940	3	50	1	....	....
Far West	370,564	81	....	....	....	....
North	298,867	212	5,438	9	....	....
North West	128,630	112	....	....	....	....
South	203,387	162	73	1	....	....
South East	109,643	82	15,849	17	10,050	10
South West	646,720	335	....	....	....	....
West	106,700	62	....	....	....	....
Totals	1,975,498	1,145	21,605	30	10,556	12

Western Division Protected Area.—In respect of sheep lice, the Western Division was declared a Protected Area, by notification under the Stock Diseases Act. The notification was preparatory to introduction of regulations requiring owners in the Area to notify the shearing-dates, to permit inspections for lice.

Proclamation re Interstate Entries.—A proclamation issued under the Stock Diseases Act prescribed the conditions of entry into New South Wales of sheep from other States, with particular reference to freedom from lice and ked.

Salmonellosis

Quarantine Policy Decision.—A policy decision was made that properties whereon the septicaemic forms of salmonellosis occurred in cattle, sheep or pigs would be quarantined for 30 days; with release 7 days after the last death or evidence of symptoms. The quarantine would not apply to affected poultry flocks.

Widespread Incidence; and the Species.—Outbreaks occurred widely, in all classes of livestock Young animals were mostly affected. Adults were involved in some cases.

In cattle, the predominant species encountered was *Salmonella typhimurium*, but *S. bovis morbificans* and *S. dublin* caused some outbreaks. The most serious mortality noted involved loss of 33 of 80 calves, due to *S. bovis morbificans.*

In sheep the disease was mostly associated with stress, excessive travelling in particular. Most outbreaks were due to *S. typhimurium*, but *S. chester*, *S. potsdam* and *S. kisarwe* also were identified.

In pigs salmonellosis was widespread. The heaviest mortality involved death of 50 to 100 6 months old pigs. Most cases were due to *S. cholerae—suis*, but other species identified were *S. typhimurium*, *S. bovis morbificanis* and *S. chester.*

In poultry all outbreaks diagnosed were due to *S. typhimurium.* The most serious involved death of 906 of 1,720 turkey poults.

General Disease Problems

MASTITIS

The "Mastitis Control Programme" Project

Work continued on the project started in the previous year; organized by a committee representing the Divisions of Animal Industry, Dairying, and Marketing and Agricultural Economics, and the Biological and Chemical Research Institute and the Biometrical Branch of this Department, together with the University of Sydney and the N.S.W. Dairy Industry Authority (previously the N.S.W. Milk Board).

The First Phase.—Phase I of the scheme operated for the full year, aimed at securing data basic to an educational programme for dairy farmers; on mastitis incidence and effect on production, and the economic benefits of control measures.

Control was based on: a sanitation system involving udder-sterilization with running water and soap, followed by drying with a paper towel, post-milking teat-dipping in iodophor (5000 ppm iodine), correct use of milking machines; removal of source of infection through treatment of clinical cases during lactation, dry-period therapy of all quarters at the end of the first lactation, and subsequently of the quarters positive to the rapid mastitis test (RMT) at drying-off; segregation of affected cows, and culling of cows with chronic mastitis.

Forty herds had been selected, throughout the State, but Phase I actually started in only 37 herds and this total was later reduced to 35 by 2 withdrawals.

Detailed records were made, to assess response to control measures. Bacteriological status of each quarter was established by 2 samplings, a month apart. Antibiotic-sensitivity tests determined the particular antibiotic to be used in the subsequent control period. The RMT was done monthly on all cows, and bacteriological determination at 3-month intervals on milk from RMT-positive quarters.

Preliminary Results.—These revealed marked decrease both in incidence of pathogens and in percentage of RMT-positive quarters. In the 17 herds in the programme for the full year, quarters positive to the RMT decreased from 36 per cent to 18 per cent; in 5 of the 17 herds the decrease was from 35 per cent to 11 per cent (a 69 per cent reduction).

Antibiotic-sensitivity Testing of Herds.—*In vitro* tests at the start of the programme showed that *Staphylococcus aureus* was resistant to penicillin in 34 and to streptomycin in 12 of the 37 herds. *Streptococcus agalactiae* was penicillin-resistant in 3 and streptomycin-resistant in 15 of the 37 herds. *Streptococcus dysgalactiae* and *Streptococcus uberis* respectively revealed streptomycin-resistance in 5 and 14 of the 37 herds. In the herds involved in the programme, *Staphylococcus aureus* was the most common pathogen.

Other Mastitis Work

Outside the "Mastitis Control Programme" project, many problems in individual herds were investigated.

In the Illawarra.—Here a determined farmer-education effort was made to reduce mastitis incidence. Milk depots in the Illawarra adopted strict milk-acceptance standards and rejected much milk because of mastitis. In a series of infected herds RMT-positive quarters were this year reduced from pre-1969–70 incidence of 25 per cent to 15 per cent. In the same period, the percentage of penicillin-resistant staphylococii increased from 75 per cent to 86 per cent. Resistance to streptomycin remained comparable.

Relative Incidence of Mastitis Organisms.—Statistics of isolations at the Veterinary Research Station, Glenfield were as follows, from 2,389 samples, from 165 herds:

Organism	Samples positive	Herds positive
	per cent	per cent
Staphylococcus aureus	27·2	67·2
Staphylococcus epidermidis	30·7	26·9
Streptococcus agalactiae	5·8	26·0
Streptococcus dysgalactiae	1·0	13·3
Streptococcus uberis	0·8	12·5
Corynebacterium pyogenes	0·3	3·0

Antibiotic Sensitivities.—At the Veterinary Research Station these were determined by the disc method. Statistics of percentages sensitive to the various antibiotics were as follow:

Antibiotic	*Staph. aureus*	*Strep. agalactiae*	*Strep. dysgalactiae*	*Strep. uberis*
	Tested 330	Tested 57	Tested 18	Tested 15
	Per cent	Per cent	Per cent	Per cent
Penicillin 51 ug	17	100	100	100
Streptomycin 25 ug	87·9	72	72·2	52·7
Chloramphenicol 50 ug	100	100	100	100
Cloxacillin 5 ug	100	100	100	100
Tetracycline 50 ug	100	100	95	100
Erythromycin 50 ug	99·4	94·7	95	86·7
Spiramycin 100 ug	99·4	94·7	95	86·7
Furazolidone 100 ug	100	100	95	93·4
Neomycin 30 ug	100	98·2	89	93·4

DRYING-OFF SYNDROME IN CATTLE

Incidence and Symptoms.—A drying-off syndrome occurred in the Moss Vale Pastures Protection District in particular, but also elsewhere—to a lesser extent. Most commonly, cows early in lactation showed the syndrome. Up to half of individual herds were affected.

Symptoms were: depression, transient pyrexia, loss of appetite, muscular stiffness, and marked drop in milk production. Initially: milk showed flakes then ropey clots, with udders becoming flaccid as in dry cows.

Recovery.—This was mostly spontaneous, in 3 to 7 days; with return to full production except where the cow became affected late in lactation.

Cause Undetermined.—Milk from affected cows reacted positive to the rapid mastitis test before clinical changes were seen in the milk, but the reactions weakened after a few days and became negative—even while clots were still in milk. Affected cows showed a leucopaenia, but attempts to culture bacteria from milk samples were unsuccessful. The cause was not determined.

Treatments Attempted.—Antibiotics infused into the udder had no effect. But there were some evidence that parenteral treatment with chloramphenicol hastened recovery.

LEPTOSPIROSIS

Incidence and Species

In Cattle.—Leptospirosis caused widespread mortality in calves and also abortion in cattle, but in abortion was less important than was brucellosis. The septicaemic form was more frequent than usual, and above-average rainfall was associated with this. *Leptospira pomona* was the pathogen in cattle.

In Pigs.—Leptospirosis was manifest by abortion, birth of dead pigs at full term, and birth of weak suckers which soon died. *Leptospira pomona* was mostly responsible, but in some cases *L. hyos* was the pathogen. In 1 abortion-outbreak, a 3-days treatment of pregnant sows with streptomycin appeared to prevent further abortions.

Sera Testings.—Of the 4,900 cattle sera tested, 263 were positive and 135 doubtful. Of the 314 pig sera, 50 were positive and 8 doubtful.

ERYSIPELAS

In Pigs.—Infection with *Erysipelothrix insidiosa* was manifest by acute sickness and mortality, arthritis and abortion. Many septicaemic outbreaks occurred, over a wide area. The arthritic form caused condemnation of many carcasses at abattoirs. Erysipelas was a less important cause of abortion in pigs than was leptospirosis, but greater use of sera-testing to diagnose chronically affected animals showed erysipelas to be more important in pig abortions than had been recognized.

In Sheep.—Mostly it took the form of chronic polyarthritism, affecting lambs in particular, but acute infection caused death of 6 sheep in 1 flock. Symptoms were: diarrhoea—passage of foetid faeces; depression, and coma; congested synovial membranes at limb joints, but little excess fluid. From the liver, kidney, mesenteric lymph glands and limb joints, *Erysipelothrix insidiosa* was recovered.

In Poultry.—The acute form of the disease caused a case of 30 per cent mortality in turkeys; and a 7 per cent mortality at a large duck-raising farm.

ENCEPHALOMYOCARDITIS VIRUS

Incidence in Pigs.—An infection believed to be encephalomyocarditis (EMC) virus caused pig mortalities in the central and southwest, at a time when mice were in plague numbers. Mortalities of up to 60 per cent occurred in pigs 2 to 12 weeks old. Most deaths were sudden, but some pigs appeared depressed for up to 4 hours before death. Salient post-mortem findings were pale areas in the myocardium, and pericarditis.

Coincidental with the disease in pigs, was heavy mortality among the plague mice. But, isolated cases of what seemed the same infection affected pigs in parts of the State where there was no plague of mice.

Attempted Identification of Virus.—Examination of specimens from rats and mice from affected areas failed to demonstrate the EMC virus. The isolate from pigs was not fully identified, but it compared well with a reference strain received from the Queensland Institute of Medical Research.

HYDATIDS AND CYSTICERCOSIS

A Scheme to Reduce Incidence

Towards the end of the year a scheme to reduce the incidence of hydatids and cysticercosis was devised. When either of the infections is found in carcasses at abattoirs, and the source-property traced, the property will be visited by an officer. All dogs present will be purged with arecoline hydrobromide to confirm the presence of tape worms and demonstrate the infection to the owner. Control-advice will be tendered; based on initial treatment of dogs, restraint of dogs and feeding only with commercially-prepared foods.

The tail-tag identification system will facilitate tracing the source of infected cattle, but tracing of sheep will present difficulties.

Extension programmes for farmer-education in the control of these infections were effected in some districts.

Incidence of Cysticercus spp.

In Sheep.—The death of over 300 lambs in 1 flock was found to be due to massive infestation with *Cysticercus tenuicollis* larvae. Livers of affected lambs showed hundreds of haemorrhagic tracks 2 mm wide on the surface of the liver and through the parenchyma, with parasites up to 4 mm long in these tracks.

In Cattle.—A survey was continued in association with the Department of Primary Industry, on incidence of *Cysticercus bovis* in cattle carcasses. Of 36 lesions examined, 3 showed a scolex of *C. bovis*. Other lesions submitted were probably degenerated *C. bovis*, but a positive recognition was not possible.

LISTERIOSIS

In Sheep.—Infection by *Listeria monocytogenes* occurred widely in sheep. In most cases it led to up to 30 per cent abortion of pregnant ewes, but there were several outbreaks of the circling form of the disease.

In Cattle.—Abortion, from this disease, also occurred in a herd of cattle; *L. monocytogenes* was isolated from an aborted foetus. Some 12 of the 57 calves born had either been born dead or had soon died. How much of the losses was due to listeriosis could not be determined; because white scours, sporadic bovine encephalomyelitis and dystokia also were associated.

PNEUMONIA

In Cattle.—Pneumonia was mostly confined to calves. The organism most commonly cultivated from infected lungs was *Pasteurella haemolytica*. Other organisms cultivated were *Corynebacterium pyogenes*, *Proteus* spp. and *Fusiformis necrophorus*.

Atypical interstitial pneumonia killed 2 cattle (with symptoms in 30 others) of a mob of 80 grazing dry natural pasture with limited access to grazing oats. The salient post mortem finding was chronic emphysema, extending throughout the lungs; with a variable degree of hepatization.

In Sheep.—The common finding in affected lungs was *P. multocida*. But, although not confirmed, many of the outbreaks seemed to be of viral origin. In 1 outbreak, involving death of 240 of 3,500 lambs, *Neisseria* spp. were isolated from affected lung tissue—in association with *P. multocida* and alpha haemolytic *streptococci*.

In Pigs.—Pneumonia was the enzootic type or was associated with *P. multocida*, *Bordetella bronchiseptica* or *C. pyogenes*.

FOOTROT (CATTLE)

Above-average rainfall in much of the State was associated with higher than usual incidence of footrot in cattle; caused by *Fusiformis necrophorus*. Two cases of benign footrot were seen in cattle, due to *Fusiformis nodosus;* in both the organism was test-transferred to sheep and produced typical benign footrot lesions.

ENTERIC CONDITIONS

In Beef Calves.—A white scours syndrome in paddock-born beef calves has been a problem almost yearly for the past decade. This year it occurred very extensively. Cause has not been determined but viral origin is considered possible.

The syndrome has regularly been in calves born between the start of summer and early autumn; and incidence related to the pasture-abundance and succulence. The high 1969–70 incidence again was associated with a favourable pastoral situation, because of high rainfall; but was featured also by earlier-than-usual occurrence, in spring. Up to 70 per cent of calf-drop were affected.

In Sheep.—The most widely met form of enteritis has been referred to as "sulpha-responsive scours", because of spectacular response to sulphonamide. Cause has not been ascertained. Characteristic of this syndrome is a thickening of the colon wall; the mucus lining assuming cobblestone-appearance. The affected bowel tissue is also abnormally fragile, particularly so in severe cases when thickness of the bowel wall approaches 3 mm.

Also in sheep: a haemorrhagic enteritis syndrome whilst grazing lucerne in the southwest. Mostly weaners were affected. On some properties the disorder occurs each autumn when weaners are first turned in to graze lucerne-paddocks. Again the cause is not known. Histopathology of tissue has suggested the possibility of a toxic chemical.

In Pigs.—Colibacillosis was widely met in pigs; as enteritis and as oedema disease.

At the Veterinary Research Station, Glenfield, the *Escherichia coli* serotypes most frequently cultured from cases of each condition were 08 in young pigs and 0141 in post-weaned pigs. Also, 045 and 0139 were sometimes cultured from oedema cases.

At the District Veterinary Laboratory, Wollongbar, 7 isolates were 0141: K 85 a, c (B); 2 were 08: K 87 B; and 1 was 045: KE 65. Unfortunately, 12 other isolates were un-typable. They were rough or did not fit any of the standard serums. A range of diagnostic antisera against 21 different pathogenic serotypes of *E. coli* was prepared in rabbits.

NECROBACILLOSIS IN CATTLE

Outbreaks of oral necrobacillosis due to *Fusiformis necrophorus* were investigated in many herds; one outbreak was associated with a relatively high incidence of footrot in cattle in the same paddock.

One severe outbreak caused death of 16 of 133 cows and 13 of 14 calves. The cattle were part of a consignment recently bought at a sale. Enquiries revealed deaths also in cattle (from the same mob) purchased by other owners.

Oral necrobacillosis also killed a stud bull at a Departmental Agricultural Research Station.

VIRAL INFECTION IN PIGS

Serological testing indicated virus FS 59E/63 in a large herd of pigs. Serum samples from 6 sows were tested (at Weybridge, England) by the haemagglutination test for antibodies of this virus. All samples showed high titres.

The subject herd of about 100 breeding sows had been under observation for 2 years because of the continued birth of dead pigs, mummified foetuses, or piglets which died within 48 hours of birth. There was a tendency for dead sows to have had small litters. Tests for the recognized causes of porcine infertility in this State had given negative results.

CENTRAL NERVOUS SYSTEM DISORDERS; SHEEP AND CATTLE

Abnormal conditions of the central nervous system met for the first time in specimens received at the Veterinary Research Station, Glenfield, included: oedema disease angiopathy, hypomyelinogenesis congenita of Hereford calves, and cerebellar degeneration in sheep associated with long-standing ataxia.

ALGAL POISONING

Anacystis cyanea.—This toxic blue-green alga was identified in eight samples of water from the Moree, Mudgee, Bathurst, Braidwood, Albury and Narrandera districts. Two samples were associated with stock poisoning. All were received in late summer-autumn.

Anabaena circinalis.—This appeared to be toxic, on circumstantial evidence. It was identified in five samples of water, in the autumn, from Bathurst, Braidwood and Albury properties. One sample was associated with the death of livestock.

Miscellaneous Activities by Veterinary Personnel

SERVICES FOR GOVERNMENT FARMS

Departmental Veterinary Officers provided a clinical and disease control service to livestock located at Research Stations and Farms of the Department of Agriculture and other Government Departments; 279 such services this year. The activities included inspections, vaccination, clinical examination, treatment, surgery, post-mortems, testing for disease, and pregnancy determinations.

TRAINING OF OFFICERS; AND CONFERENCES

Clinical and Laboratory Diagnosis.—Veterinary Officers and Veterinary Inspectors attended a three-day course conducted by the Post Graduate Committee in Veterinary Science. Facilities of the Veterinary Research Station, Glenfield, were used for the course.

Extension Methods.—Veterinary Officers and Veterinary Inspectors also attended schools conducted by the Division of Extension Services.

Ranger Training.—For Rangers in the Western Division, required to undertake elementary veterinary studies, a school was held. Also, a workshop where district staff were instructed in the tail-tagging scheme for sale cattle was held in the north-eastern District.

Induction of New Veterinaries.—Newly appointed Veterinary Officers and Veterinary Inspectors spent several days at the Veterinary Research Station, Glenfield. Veterinary Inspectors also spent several weeks with an experienced Veterinary Inspector before proceeding to the respective appointment District.

In-service Conferences.—A three-day conference of senior veterinary personnel was held at head office and the Veterinary Research Station, Glenfield, on general matters. A one-day conference for District Veterinary Officers was held at head office to discuss the introduction of new schemes for the control of tuberculosis and brucellosis.

Most Veterinary Inspectors attended the Annual Conference of the Veterinary Inspectors Institute.

Official veterinary personnel in the southern and southwestern Districts held a conference on footrot. A local one-day conference was held in six Veterinary Districts to discuss "extension programme planning", and in one District to discuss general matters. A footrot-eradication conference was held at Armidale. The Bourke District Veterinary Officer attended a Brisbane conference on St George Disease.

EXTENSION SERVICES BY VETERINARY PERSONNEL

Individual Contacts, Group and Mass Media

While much extension was done on an individual-contact basis by Veterinary Officers and Veterinary Inspectors, group and mass means of extension were also undertaken.

Seventy sessions were conducted by veterinary personnel at schools and meetings organized in association with primary producer bodies—mostly the Agricultural Bureau. Demonstrations were given at 35 field days. Fifty-eight radio broadcasts were delivered; 243 press items were released to country newspapers; 12 telecasts were made; and 7 newsletters were circulated to stockowners. A display on hydatid disease, including continuous slide projection, was stage at an agricultural show.

In one Veterinary District, after checking the records for anthrax outbreaks for the past 30 years, current owners of the properties concerned were written to—the letter including a recommendation of preventive vaccination.

Programmed Extension Goals

In accordance with the official policy, veterinary personnel drew up extension programmes and work plans based on the major problems and needs in their districts. Subjects selected for extension in this manner were as follow: Promotion of pregnancy diagnosis in beef cattle; Promotion of use of breeding records for dairy cattle; Control of brucellosis in cattle; Control of sheep footrot; Control of mastitis in cattle; Determination of cause of pig mortalities and their control; Control of infertility in cattle; Discouraging the consignment of pregnant cattle to meatworks; Control of sheep lice; Control of feral pigs; Encouraging the correct timing of clostridial vaccination; Control of hydatids; Control of lice in beef cattle; Prevention of ovine posthitis; Prevention of pregnancy toxaemia in sheep.

Publications

Four issues of the quarterly *Veterinary Notes* were produced; distributed to official veterinary personnel and to external veterinarians serving the livestock industries. The 1968–69 issue of *Livestock Health and Husbandry Report* was prepared; covering the work of the Division of Animal Industry.

ARTIFICIAL STOCK-BREEDING MATTERS

Regulations Amended

Concerning Sheep.—Regulations under the Stock (Artificial Insemination) Act were amended, by adding regulations controlling the artificial insemination of sheep. Previously, only the insemination of cattle had been subject of regulations.

Concerning Bulls.—Amendments to the regulations removed a minimum-age requirement for bulls, and eliminated a requirement that they should be registered with a breed society.

Concerning Semen Containers.—An amendment was made to permit use of approved plastic straws, as an alternative to glass ampoules as semen-containers.

Beef Cattle Insemination Centre Registered

A new Artificial Insemination Centre was registered, to supply semen specifically for beef cattle. This is the first privately-run Centre in New South Wales. The two Centres previously established are operated by the N.S.W. Dairy Industry Authority (formerly the N.S.W. Milk Board).

Beef Cattle Semen Imports

Semen imported into the State from the United Kingdom comprised 6,328 doses from 19 bulls of 5 breeds; including 4,005 doses from 8 Charolais bulls. Importation of semen and the occurring expansion in beef cattle raising has led several organizations to contemplate the establishment of insemination centres.

Training Inseminators

Improvements were made in the method of training artifical-inseminators.

Pathology-testing of Bulls for Centres

All bulls proceeding to artificial breeding centres were first tested at the Veterinary Research Station, Glenfield, for genital and other diseases. The testing involved: mating with virgin heifers; examination of material for bacterial and protozoal infections; and serological and tuberculin testing.

Thirty-six bulls were so tested; as against only thirteen in the previous year. Two were rejected; one for tuberculosis and the other because of actinobacillosis.

All bulls already at artificial breeding centres were given their annual tests for tuberculosis, brucellosis, leptospirosis, and pleuropneumonia, and were treated as a precaution against vibriosis.

EXOTIC DISEASES: ANTICIPATORY ACTIVITIES

Study Visits

Two senior officers visited Thailand and Indonesia for two months, for training in recognition and control of exotic diseases.

A senior officer attended an exotic diseases training school conducted by the Queensland Department of Primary Industries.

Mapping by Valuer-General's Department

At the instigation of this Department, the Valuer-General has set up a work force to draw Shire maps showing boundaries of all rural properties. These will be invaluable to the Department of Agriculture in the event of outbreaks of exotic diseases.

Liaison with the Armed Services

A firm arrangement was made for the three armed services to provide help in the event of an outbreak of foot and mouth disease. The assistance would be mainly by way of transport, tentage, communications, personnel, and equipment.

Wild Pigs, Eradication Campaign

A campaign for eventual eradication of wild pigs was started. The considerable number of wild pigs in New South Wales could be a serious obstacle to the successful eradication of several exotic diseases if the latter entered Australia. Wild pigs are proclaimed noxious animals, throughout the State; providing for enforcement of control measures.

An initial phase of the campaign will publicize the importance of wild pigs in relation to exotic disease outbreaks, and the control measures devised to deal with pigs in difficult country. Then the legislative provisions will be utilized to require landowners to deal with wild pigs on their properties.

LABORATORY DIAGNOSTIC SERVICES

Glenfield, Armidale, Wollongbar

Notable Increases in Specimen Totals.—The volume of material submitted to Glenfield and to the 2 District laboratories (Armidale and Wollongbar) has markedly increased. Specimens to Glenfield totalled 8,414 (22 per cent more than in the previous year); to Armidale, 1,771 specimens (25 per cent more); to Wollongbar, 1,452 (15 per cent more).

These increased service-demands demonstrated the importance of laboratory assistance to the field veterinarians during their investigations of animal health problems. The handling of this volume of specimen material reduced the opportunities for staff to accept new research commitments.

Effect of Special Programmes, Campaigns, etc.—Laboratory involvement in the plans for the control of bovine brucellosis and tuberculosis, and in the State Mastitis Control Programme, increased the work-load considerably. Testing of biological products, including *Brucella* vaccines, and the investigation of rapid diagnostic techniques for brucellosis, in conjunction with other States' Departments of Agriculture, were additional commitments.

Effect of Private Practitioners.—Resort to the laboratories' services by veterinary practitioners also increased. Specimens from practitioners comprised 32 per cent of the total at Glenfield, 38 per cent at Armidale, and 44 per cent at Wollongbar.

Specimen Statistics

The following table shows the *totals (and animal classes) of consignments of specimens* received at the Veterinary Research Station, Glenfield, the Colin Blumer District Veterinary Laboratory, Armidale, and the District Veterinary Laboratory, Wollongbar:

Class of animal	Glenfield	Armidale	Wollongbar
Cattle	4,683	1,024	1,173
Sheep	1,784	364	....
Poultry	571	159	25
Pigs	656	167	190
Horses	40	....	....
Other Animals	329	45	48
Plants	164	....	....
Miscellaneous	187	12	16
Totals	8,414	1,771	1,452

The following tabulation indicates *the submission-sources of diagnostic material* received at the 3 laboratories:

Submission source	Glenfield	Armidale	Wollongbar
Departmental officers	926	281	354
Veterinary Inspectors	4,081	768	414
Veterinary practitioners	2,746	679	637
Others	661	43	47
Totals	8,414	1,771	1,452

SUPPLIES OF RABBIT MYXOMA VIRUS

Fewer Requests but Large Orders

Requests for virus were fewer this year but because of some large orders the quantity of virus distributed was similar to that of the previous year. The total of 133,200 rabbit doses of virus distributed included 15,820 to Queensland, South Australia, Western Australia, Australian Capital Territory, and the CSIRO.

Enquiries About a Vector

Many enquiries were received concerning availability of the European rabbit flea to spread myxomatosis. This flea, introduced three years ago, is still being studied in field trials by officers of the CSIRO Genetics Division. Results of these trials are likely to be considered later in the ensuing year, when decisions will be made about the value of releasing the vector throughout the various States.

Matters Arising from Some of the Acts

STOCK FOODS AND MEDICINES ACT MATTERS

Stock Foods Activities

Registrations.—Of the applications for registration of stock foods, 1,710 were approved; about 25 per cent fewer than in the previous year. The fewer registrations reflects cessation of a number of small firms or their absorption by larger manufacturers.

In some cases the registration of stock foods had to be deferred, the applicants being unaware of new regulations (under the Poisons Act) limiting the concentration of antibiotics. A regulation was gazetted prohibiting sale of any stock feed wherein hexachlorobenzene is above 0·01 ppm. This action followed detection of higher levels in poultry feeds, and resultant residues in excess of 1 ppm in eggs.

Inspections and Analyses.—Inspectors appointed under the Stock Foods and Medicines Act, co-operated with officers of the Poisons Branch of the Public Health Department to inspect stock food manufacturing premises. Of the 57 samples submitted to the Biological and Chemical Research Institute of the Department of Agriculture for analysis, 13 samples were found to be below the required standard.

Stock Medicines Activities

Registrations.—The Stock Medicines Board considered 2,019 applications; 55 more than in the previous year. Of these, 1,535 were for annual registration of previously registered products while 220 were for new preparations.

Registration of three products was refused by the Board, and thirteen applications were withdrawn by applicants.

Liaison.—The Stock Medicines Board maintained liaison with the Commonwealth Technical Committee on Veterinary Drugs, and with the Poisons Branch of the New South Wales Public Health Department which administers the Poisons Act.

The Board forwarded a circular to all vaccine manufacturers asking that they instruct their agents in the correct method of storing vaccines.

CATTLE COMPENSATION ACT MATTERS

Claims Approved for Payment

These totalled 6,475; as against 7,626 in the previous year. The total of cattle for which compensation was paid also declined, from 10,431 to 9,290. But the number of cattle for which compensation was paid on account of tuberculosis increased by 261 compared to the previous year. Statistics of claims for the various diseases are as follows:

Disease	Claims	Animals	Payments (to nearest $)
			$
Tuberculosis	440	1,440	40,499
Cancer	3,826	5,308	170,217
Actinomycosis	1,704	1,961	58,778
Actinobacillosis	489	565	17,508
Contagious pleuro-pneumonia (i.e. animals not affected)	4	4	400
Trichomoniasis	....	....	....
Tick Fever	9	9	683
Johne's Disease	2	2	92
Vibriosis	1	1	90
Totals	6,475	9,290	$288,267

Claims Disallowed or Reduced

Claims for which compensation was disallowed, and the reasons, were: delayed notification by owners, 151; failure to notify disease, 33; failure to pay levy or submit return, 4; and delayed application for compensation, 3; total—191.

The amount of compensation payable was reduced in 87 cases where the claim was not submitted within 60 days of the slaughter of the cattle.

PROSECUTIONS

Stock Diseases Act.—Eight successful prosecutions were undertaken under the Stock Diseases Act or its regulations: 4 for failure to report presence of sheep lice, 2 for attempting to sell lice-infected sheep, 1 for failure to boil pig-swill, and 1 for failure to report footrot in sheep in the New England Protected Area.

Veterinary Surgeons Act.—Two unqualified persons were successfully prosecuted under the Veterinary Surgeons Act, for illegal practice of veterinary science.

Board of Tick Control-Cattle Tick Control

STAFF NEEDED

Staff increased from 501 to 511 during the 12 months. More staff are likely to be needed in the ensuing year; because of re-establishment of the Boonoo Boonoo Quarantine Area, the dipping-policy west of the Richmond Range, and intensified programmes where infestations have been noted. Control of ticks resistant to organic phosphate caused a drain on staff resources.

There was a staff-turnover of 38 through retirement, resignation, death, termination of services, or transfer to other Branches of the Service. Engagement of sufficient, suitable staff to fill vacancies as they occur is difficult.

CATTLE TICK (*BOOPHILUS MICROPLUS*) ERADICATION MATTERS

The Situation in Various Areas

Barcoongere Quarantine Line.—A section of the Grafton Quarantine Area, severed by this line, was released to clean country. For 12 months there had been no cattle or horses within it. The Barcoongere Quarantine Line then became the external southern boundary of the Grafton Quarantine Area.

Rocky River Quarantine Area.—This Area, established in clean country adjoining the Tabulam quarantine boundary—because of a breakthrough of a beast, was released from quarantine. It had been kept free of stock for a year.

Hickey's Holding; Ti-Tree.—An area of 158 acres at Ti-Tree, which had to be emptied of stock and leased for eradication—because of re-alignment of the quarantine boundary of the Tabulam Quarantine Area, was kept under surveillance. After the area had been kept free of stock for a period of 12 months, it was released into clean country.

CATTLE TICK CONTROL POLICIES

The Situation in Various Areas

A dipping policy was again implemented east of the Richmond Range. But west of that range, examinations were done in the autumn on holdings with a history of tick infestation during the previous 5 years, and on adjoining holdings.

Areas East of the Richmond Range.—Stock on holdings within the Richmond, Kyogle, and Tweed Areas were given 6 treatments at 21-day intervals between September and February. On average, 482,233 head were treated on each round and 11,378 examined. Seasonal conditions during the dipping programme were particularly good and the treatments were completed without incidence. Dipping of all calves under the age of 4 weeks was again enforced, and efforts to obtain full musters were increased. The problem of driving stock along busy highways continued to increase.

In the following table, note that the level of infestations reported remained much the same as in 1968–69. There was no recurrence of infestation at Bentley and on the Mackellar Range.

Area	Number of infestations				
	1965–66	1966–67	1967–68	1968–69	1969–70
Richmond:					
Bangalow	2	3	18	4	5
Lismore	9	2	3	1	....
Nimbin	8	7	10	....	1
Casino	20	12	14	1	....
Rappville	....	....	1	....	....
Kyogle	5	3	7	11	11
Tweed	3	....	1	4	3
Totals	47	27	54	21	20

Areas West of the Richmond Range.—The policy requiring examinations to be done at 21-day intervals on holdings, known to have been infested during the past 5 years, and on those adjoining, was implemented as from February, 1970. This policy revealed 15 infestations; 12 of these were light.

It is interesting that there were 85 holdings with a history of infestations, and 175 holdings adjoining, involved; so the detection of 15 infestations implied either that previous control methods had been reasonably successful *or* that conditions throughout most of the Areas West of the Richmond Range had not particularly favoured tick life. The latter is supported by the ecological studies in recent years.

Examinations in the Cullendore Area failed to reveal any further evidence of tick life. But inspection teams' summer and autumn operations in clean country adjoining the Cullendore Quarantine Area led to detection of a single tick-infestation on a Liston property. A single tick-infestation had been previously detected on an adjoining property within the Cullendore Area.

This detection led to re-establishment of the Boonoo Boonoo Quarantine Area north of Jenner's Creek. The Maryland Area remained excluded from quarantine, as examination failed to reveal any evidence of tick life there.

A programme of examinations on holdings adjoining the infested holding at Liston was started, and examination of other holdings adjoining Cullendore Area continued. This resulted in detection of a further, light infestation on another holding adjoining the Cullendore Area and near the infested Liston holding. This supported the action taken to re-establish the Boonoo Boonoo Area.

Details of infestations recorded west of the Richmond Range are shown in the following table:

Area	Number of infestations				
	1965–66	1966–67	1967–68	1968–69	1969–70
Bonalbo	1	2	9	16	13
Tabulam	11	5	2	1	6
Woodenbong-Legume	2	7	....	....	10
Cullendore	....	....	1	6	....
Boonoo Boonoo	....	....	....	....	2
Totals	14	14	12	23	31

Grafton and Copmanhurst Areas.—Examinations of stock on holdings with a previous history of cattle tick were stepped up. At Fineflower a heavy infestation of cattle tick was detected. Cattle from the property had been found infested at Grafton Abattoir, after passing through the Grafton Saleyards. There had been a mixed infestation of *Boophilus microplus* and *Haemaphysalis longicornis*. Cattle on an adjoining holding that had been found infested last year, and had been undergoing examinations at 21-day intervals, were again found infested. The 2 properties aggregated some 16,000 acres; much of it difficult to muster.

Finding of the first infestation emphasized the importance of inspecting cattle presented for slaughter at Grafton Abattoir. Because the infested cattle had been placed in the holding-paddocks at Grafton Abattoir, restrictions had to be imposed on movements of cattle out of these paddocks. This need became more evident when an infestation was detected on a beast that had been running in the holding-paddock for some months.

Only few voluntary treatments were undertaken in the Grafton-Copmanhurst Area during the year; despite strong preceding representations for such treatments to be permitted.

Policy re Infested Properties

Herds found infested with cattle tick were quarantined and given 4 dippings at 21-day intervals. Detailed inspections accompanied the last 3 treatments, and if cattle tick was found the dipping programme continued until the stock had had 3 treatments without cattle tick life being apparent. On completion of the dippings, herds were examined for ticks 4 times at 21-day intervals.

In the quarantine period, movement of cattle for slaughter was subject to clean-inspection and dipping. For cattle moving elsewhere the requirements were 2 clean-inspections and dippings.

East and west of the Richmond Range, herds on properties adjoining those found infested were examined 4 times at 21-day intervals. The policy revealed a number of infestations. Towards the end of the year, this policy was extended throughout all Tick Quarantine Areas.

ACARICIDE RESISTANCE IN TICKS

Ridgeland- and Biarra-type Resistances Detected

Early in the year, the Ridgelands-type resistance was confirmed on 3 properties in the Bonalbo Quarantine Area. Subsequently a few of the ticks selected from the original sample from one holding also showed a potential for Biarra resistance. A change of acaricides, from ethion to dursban, was dictated by the events. Later, ticks collected from one beast in the Bonalbo Quarantine Area, showed a very low percentage of Ridgeland resistance.

Special Quarantine Areas and an Eradication Programme

Special Quarantine Areas had to be gazetted to include all confirmed "resistance-properties", together with those adjoining. On the infested properties, an eradication policy of fortnightly dippings for 10 months was instituted. Stock on adjoining holdings were placed on 3-weeks examinations for the same period.

Difficulties were experienced throughout the year on one property where the large area and rough terrain made full musters extremely hard; aggravated by insecure fencing.

In the Clunes Special Quarantine Area (Biarra resistance) ticks identified as *Boophilus microplus* were collected from a property in September, 1969. This necessitated a 10 months dipping programme for the infested herd and an extension of time for examination in all other holdings in the area. No other tick was subsequently found. At 30th June, 1970, release of the Area from quarantine was being considered.

During the year engorged female ticks were collected from 10 properties in the Bonalbo, Tabulam, Kyogle, and Tweed Areas and forwarded to the CSIRO Veterinary Parasitology Laboratory, Brisbane, for acaricide-resistance testing. It was in one of the Bonalbo samples that Ridgelands-type resistance was confirmed. Results on some of the other samples were still being awaited at 30th June, 1970.

INSPECTION OF STOCK AT ABATTOIRS

Examinations were continued at Grafton, Casino, Byron Bay, Macksville, and Tenterfield Abattoirs. *Haemaphysalis longicornis* and *Ixodes holocyclus* were found at all except Tenterfield, and, previously stated, cattle ticks were detected at the Grafton Abattoir.

At Tenterfield Abattoir.—The Assistant Inspector continued to supervise the unloading of cattle consigned to the Abattoir by rail from Wallangarra and the dipping of all ex-Queensland calves prior to slaughter. Cattle at the Tenterfield Abattoir were also checked for tick life.

At Casino and Byron Bay Abattoirs.—The Assistant Inspector continued to examine calves and cattle presented for slaughter. No evidence of cattle tick was found, and this pointed to the satisfactory control of cattle ticks throughout the Tick Quarantine Areas. Staff there also supervised the slaughter of cattle from tick fever holdings, and cattle from clean country.

INSPECTIONS IN CLEAN COUNTRY

Inspection teams operated during the summer in clean country adjoining the Cullendore Quarantine Area. They detected cattle ticks on two properties adjoining the Cullendore/clean country boundary. Examinations were also made south of Grafton in clean country, but restricted by the need to deploy staff in other areas.

CURRUMBIN VALLEY (QUEENSLAND) DIPPING PROGRAMME

A dipping programme to control cattle ticks in the Currumbin Valley, Queensland, and thus reduce the danger of ticks spreading across the border into New South Wales, was started in September, 1969 in conjunction with the Queensland Department of Primary Industries. All stock in the Valley were subjected to 11 treatments, at 21-day intervals.

At the end of the period there were still 5 problem-herds, through breakdowns associated either with difficulties in mustering or the presence of Biarra-strain resistant-ticks. Treatments on these properties have continued at 14-day intervals.

In general, the programme was quite successful. Co-operation from the majority of stock-owners was good.

THE ACARICIDE TOXICITY SITUATION

As regards toxicity following dipping there has been little change from the previous year's situation. A further study of losses for the 12 months ended June, 1969, was completed. This revealed that there had been 232 mortalities in cattle. For these the Board's recommendation for compensation was followed. The 232 represented a mortality-rate of 5·23 per 100,000 head of cattle dipped. Sixty-six of the 232 deaths resulted from misadventure.

It was noted that neither of the acaricides in most common use, (delnav and ethion) was the more toxic; that very young animals were again the most susceptible, that over half of the losses from suspected organophosphate poisoning were stock less than 3 months old.

The policy of converting dips from delnav to ethion was continued and helped prevent the spread of Ridgeland-strain resistance. At 30th June, 1970, the total of dips charged with delnav was 707; with ethion, 650. There were also 15 dips charged with dursban, 3 with sevin and 1 with nexagan.

THE TICK FEVER SITUATION

Incidence

Six outbreaks were recorded. Two clinical outbreaks (*Babesia argentina*) involved single deaths in the Tweed Area; 3 clinical outbreaks (2 of *Babesia argentina* and 1 of *Babesia bigemina*) in the Kyogle Area also involved single animals. The sixth outbreak was due to transmission-test detection of a carrier-animal (of *Babesia argentina*) on a property adjoining an outbreak-holding in the Kyogle Area. No cattle tick was found on any of the outbreak-properties or adjoining holdings.

An animal carrying a Queensland brand was detected at Casino after sale. It had come from a Copmanhurst property, New South Wales, and been illegally introduced into the Grafton Area some 3 years earlier. Tests showed it to be a carrier of *B. argentina* and it was destroyed. Testing of the herd on the Copmanhurst holding showed no spread of the infection to other animals.

Blood Testing and Releases in the Quarantine Areas

Blood testing for tick fever in the Tick Quarantine Areas involved the bleeding of 9,285 head of stock.

The previously recorded tick fever holdings were released from quarantine, the herds having completed the required 10 months' treatments at fortnightly intervals and been blood tested with negative results.

Reactions to the New Policy

The new policy for tick fever did not meet with any strong opposition. Some stock owners on adjoining holdings complained about their holdings being held in quarantine; awaiting blood-test results. Delays were due to the slow, maximum rate of testing at the Cattle Tick Research Station.

Statistics of Tick Fever Outbreaks (Four Years)

The following table summarizes tick fever outbreaks since 1966–67:

Area	1966–67		1967–68		1968–69		1969–70	
	Holdings	Head	Holdings	Head	Holdings	Head	Holdings	Head
Kyogle	10	1,042	1	114	..	..	4	729
Tweed	11	1,155	2	213	..	..	2	136
Richmond ..	..	..	1	73	2	117	..	..
Woodenbong ..	1	204	1	701	1	271	..	..
Legume	..	..	2	135	..	..	..	..
Bonalbo	1	104	..	..	2	611	..	..
Totals	23	2,505	7	1,236	5	999	6	865

CLAIMS FOR COMPENSATION

Compensation claims were paid for loss of 207 head of stock by death or injury; involving roundly $9,825.

FENCING, DIP AND BUILDING CONSTRUCTION, AND VEHICLES

Fencing.—Some 21 miles of new fence was erected and 42 miles of repairs done to existing fences on the external and internal quarantine boundaries. The new included 14 miles of buffer fence on the southern boundary of the Grafton Quarantine Area, and also 2½ miles of fence on the external boundary of the Copmanhurst Area. Repairs to some 32 miles of fencing on internal and external boundaries in the Woodenbong, Cullendore, and Boonoo Boonoo Areas were major.

Dips.—Six new dips were built and 464 dips and dip yards were repaired. Ninety-two dip yards were gravelled. To obtain round and split timber to repair or construct dip yards has become very hard in some areas.

Building Programme.—This provided construction of 11 new huts and 5 tent-units; and repairs to 14 cottages, 7 huts and 3 tent-units. Also, 4 tent-units were reroofed with galvanized iron, and construction of a new office building at Woodenbong has started. Electricity was connected to a cottage at Legume and water was connected to staff quarters at Tweed Heads. A survey was undertaken towards improved staff-accommodation.

Vehicles.—Two tipping trucks, 1 heavy truck, 1 sedan, and 7 landrovers were replaced. The fleet was increased by purchase of a car. An unserviceable tractor was sold.

THE BOARD OF TICK CONTROL LABORATORY WORK

The massive statistics of analytical work by the Laboratory has been appropriately recorded in other papers. The statistics concern, in respect of each of the several dip chemicals: the number of dip samples, of stock dipped, of hair-dunking tests, of residues in tissues and in butter samples, of post-mortem samples, of biopsy samples, of cattle swabs; and many other sub-headings.

Queensland Border Control

INSPECTORIAL STAFF

Inspectors to control the introduction of stock from Queensland totalled 68 employed full-time and 8 part-time.

The west of Mungindi and the Tibooburra Sections of the Border were brought under the administration of the Bourke District Veterinary Officer this year. Because of greatly increased stock movements, 2 full-time Inspectors were appointed to the west of Mungindi Section—hitherto operated by part-time Inspectors. The Tibooburra Section remained the only 1 staffed entirely by part-time Inspectors.

STOCK MOVEMENTS

Due to a very favourable season in northern New South Wales and drought conditions in Queensland there was, by comparison with the previous year, a 48 per cent increase in the total of cattle entering *from* Queensland. In other respects, stock movements remained much as they were in the previous year. The 2 following tables show the totals of stock which moved across the Border between New South Wales and Queensland:

From Queensland to New South Wales

Administrative section	Cattle	Sheep	Pigs	Horses	Goats
Stanthorpe	131,337	26,272	36,005	2,611	....
Goondiwindi	570,226	1,446,962	536	7,825	20
West of Mungindi	153,659	1,562,949	....	2,371	5,279
Tibooburra	14,012	5,326	....	152	....
Totals	869,233	3,041,509	36,541	12,959	5,299

From New South Wales to Queensland

Administrative section	Cattle	Sheep	Pigs	Horses	Goats
Stanthorpe	36,658	365,474	1,589	1,031	....
Goondiwindi	141,208	678,026	2,462	1,520	2
West of Mungindi	4,309	111,255	....	316	23
Tibooburra	....	....	....	28	....
Totals	182,175	1,154,755	4,051	2,895	25

Unauthorized Stock Crossings

In part of the Goondiwindi Section, where the Border is not fenced and the MacIntyre River comprises the boundary between the 2 States, there were isolated cases of unauthorized stock-crossings. The low level of the river, due to the Queensland drought, was a factor. Patrolling of this part of the Border was intensified.

CONSTRUCTIONAL WORK AT THE BORDER

Some 450 chains of fencing along the Border was replaced. Renovations and repairs were effected to 19 cottages, 4 camp-units and 2 offices. Ten stock-crossing places were improved. Two dip yards were renovated. Arrangements were in hand to replace 2 cottages destroyed by fire.

Meat Inspection Service

STAFF

At 30th June, 1970 the professional/technical staff of the Meat Inspection Service was as follows: the Principal Veterinary Officer (M.I.), Assistant Principal Veterinary Officer (M.I.), and 2 Veterinary Officers; the Supervising Senior Meat Inspector; 222 Meat Inspectors, including Seniors, and 3 vacancies; 23 Brand Boys and 2 vacancies.

ACTIVITIES OF THE MEAT INSPECTION SERVICE

Ante- and Post-Mortem Inspections

Ante-mortem inspection of cattle was done at Homebush Saleyards on 3 days weekly, and of pigs once each week. All cattle were inspected on receival at Homebush Bay Abattoir. All animals were inspected on the day of slaughter at all works. Ante-mortem inspection of pigs, calves, and sheep was done before slaughter.

Animals being submitted for emergency-slaughter were examined at all abattoirs before they were killed. In some areas this service was extended to private properties.

Post-mortem inspection was done at the time of slaughter at the State Abattoir, Homebush Bay, the Riverstone Meat Works, Riverstone, at 2 small licensed-meatworks in the metropolitan area, and at these country centres: Aberdeen, Berrima, Blayney, Byron Bay, Casino, Dorrigo, Dubbo, Forbes, Gosford, Goulburn, Guyra, Gunnedah, South Grafton, Inverell, Moree, Mudgee, Macksville, Orange, Tenterfield, Wagga Wagga, Wallangarra, Woy Woy, Wingham, and Yanco. Horse carcasses were inspected in 1 pet-food knackery; 3,784 horse carcasses (and 1 of cattle).

All meat introduced into the Metropolitan Abattoir Area was re-inspected, and meat-handling at Meat Markets in the Metropolitan Area was supervised. Smallgoods factories were regularly inspected by officers located at the city office.

Statistics of Carcass Inspections

The totals of animals slaughtered at abattoirs where State Meat Inspectors are located are in this table:

(* Excludes export; in the 2 cases so marked)	Cattle	Calves	Pigs	Sheep
State Abattoir	126,222	53,171	177,833	2,025,540
*Inside County of Cumberland	11,863	15,004	46,891	545,975
*Country areas	589,912	128,070	590,761	7,271,409
Totals	727,997	196,245	815,485	7,271,409
For Export:				
Cumberland	50,320	2,897	133	209,047
Country areas	229,083	18,450	1,114	2,312,738
Totals	279,403	21,347	1,247	2,521,785
Total Kill	1,007,400	217,592	816,732	9,793,194

TOTAL AND PARTIAL CARCASS CONDEMNATIONS

"*Total-Carcass Condemnation*" *Percentages*

Reason	Cattle	Calves	Pigs	Sheep
	Per cent	Per cent	Per cent	Per cent
Actinomycosis and Actinobacillosis	0·001	..	..	..
Arthritis	0·015	0·067	0·515	0·069
Caseous lymphadenitis	..	..	..	0·035
Cysticercus ovis	..	..	..	0·011
Emaciation	0·019	0·005	0·006	0·121
Sarcosporidiosis	..	..	..	0·015
Septic Conditions	0·022	0·017	0·075	0·007
Tuberculosis	0·034	0·001	0·016	..
Other Conditions	0·111	0·218	0·096	0·073
Totals	0·202	0·308	0·708	0·331

"*Partial-Carcass Condemnation*" *Percentages*

Reason	Cattle	Calves	Pigs	Sheep
	Per cent	Per cent	Per cent	Per cent
Actinomycosis and Actinobacillosis	1·837	0·003	..	..
Arthritis	0·290	0·019	0·897	0·148
Caseous lymphadenitis	..	..	..	..
Cysticercus ovis	..	..	..	0·186
Emaciation	..	..	..	..
Sarcosporidiosis	..	..	..	..
Septic Conditions	0·022	0·002	0·064	0·011
Tuberculosis	0·026	0·001	0·018	..
Other Conditions	1·029	0·022	1·345	0·034
Totals	3·204	0·047	2·324	0·379

LIVER CONDEMNATION PERCENTAGES

Records of the causes of liver condemnation are not normally kept but the next 2 tables set out (for 4 years) the percentages of cattle and sheep livers condemned for various diseases, based on random-sample surveys:

Cattle Livers

Reason	1964–65	1965–66	1966–67	1967–68	1968–69	1969–70
Liver Fluke	22·4	30·8	22·5	17·0	13·5	14·7
Hydatid	1·9	2·2	1·5	1·1	0·96	1·1
Adhesions	....	....	....	....	1·45	0·9
Abscess	....	....	....	....	....	1·9
Contamination	....	....	....	....	0·85	0·9
Telangiectasis	....	....	....	....	0·48	0·5
Others	....	....	....	....	....	0·06

Sheep Livers

Reason	1966–67	1967–68	1968–69	1969–70
	Per cent	Per cent	Per cent	Per cent
Cysticercus tenuicollis	11·4	15·2	14·5	14·7
Hydatid	3·9	6·6	6·4	6·9
Caseous Lymphadenitis	..	..	0·3	1·1
Fluke	11·5	8·6	4·2	9·9
Adhesions	..	..	3·5	5·9
Parasitic	..	..	0·8	0·7
Contamination	..	..	0·48	0·7
Melanosis	..	..	0·15	0·3

PET FOOD RE-EXAMINATIONS

Re-examination of pet food collected at Homebush showed: 111 ox livers infected with hydatids, 6 sheep livers, 236 ox lungs, and 399 sheep lungs. All of this material was destined for canning.

SURVEY OF INCIDENCE OF *CASEOUS LYMPHADENITIS*

A survey indicated that a minority of flocks showed no infection, and that incidence in individual animals has varied very little since the last survey (in 1927). Inspection levels were: lambs 19·5 per cent; ewes 22·8 per cent; wethers 31·8 per cent; rams 16·9 per cent; all ages 19·5 per cent; and all adult sheep 28·3 per cent.

TOTAL OF MEAT INTRODUCED INTO THE METROPOLITAN ABATTOIR AREA FROM WITHIN NEW SOUTH WALES

The quantities of meat inspected after introduction into the Metropolitan Abattoir Area from within New South Wales were as follow: *Beef*—carcasses 430,063½, piece meats 6,855,242 lb; *Veal*—carcasses 113,534, piece meats 119,442 lb; *Pork*—carcasses 463,053, piece meats 713,428 lb; *Mutton*—carcasses 3,930,042, piece meats 2,147,736 lb; *Bacon*—1,037,491 lb; and Sundries 9,519,201 lb.

Services under the Commonwealth Quarantine Act

The Division of Animal Industry continued to administer certain sections of the Quarantine Act, 1908–1969 for the Commonwealth Government.

Two Veterinary Officers, 1 Senior Port Inspector, and 16 Port Inspectors did the animal quarantine work at Sydney and Port Kembla. The District Veterinary Officer and 1 Port Inspector did the work at Newcastle.

The Port Inspector staff was increased by 7 this year; towards effective manning of the new overseas passenger terminal at Sydney (Kingsford-Smith) Airport and adequate coverage of enlarged commitments in other fields of animal quarantine work.

INWARD AND OUTWARD INSPECTIONS

Animal Imports

Total prohibition remained on importations of sheep, goats, and pigs into Australia. Because a rabies case occurred outside quarantine in the United Kingdom, in October, 1969, a complete ban was placed on importation of dogs and cats from the U.K. and Ireland. Up to the introduction of the ban, 96 dogs and 31 cats came in from there; as against 254 dogs and 55 cats in the 1968–69 fiscal year.

Imports of other permissible animals were numerically comparable to those of 1968–69. Bird, fish, queen bee, zoo, and laboratory animal totals increased slightly. Cattle imports from New Zealand were much increased; one consignment of 414 beasts contributed significantly. Horse imports decreased slightly.

Cattle semen consignments from the U.K. and New Zealand reached a total of 7,704 doses; double the previous year's total.

Three attempts to smuggle birds into New South Wales from overseas by air were detected; 448 birds in one incident—by far the greatest single attempt at smuggling of animals ever detected. An organized ring was associated.

Imports of Animal Products

Imports of cheese, tinned meats, animal casings, milk and egg products, noodles, and stock feed supplements increased. Shipments totalling over 12·5 million lb of soybean meal from the U.S.A. accounted for most of the stock feed. Fish meal imports decreased. No meat meal was imported from New Zealand.

Decreases were recorded for hides and skins, hide pieces, furred skin, wool, hair, feathers, and chilled meat imports.

Six consignments (149,216 lb) of frozen meat of Australian origin were returned from the U.S.A. after entry-refusal there; a consignment (22,080 lb) also returned from Canada. The total a slight decrease on that returned in 1968–69.

Passengers' Baggage

Co-operation with Customs officers continued, in searching for illegal goods in the baggage of passengers arriving by sea and air. For main items the totals of seizures were 4,325 lb meat, 2,527 lb cheese, 1,836 lb trahana, and 967 eggs.

The meat and egg totals were increases on the previous year. But a study of seizures, overall, from sea passengers' baggage, revealed a considerable reduction by comparison with 1968–69. Possibly the migration policy of more air transport had considerable influence on that trend. The quantity of goods seized from air passengers showed an increase, in all major categories.

Passenger arrivals by air were 641,950 and by sea 106,585; as against respectively 555,870 and 117,475 in 1968–69.

Disinfection of Footwear and Clothing

Disinfection of footwear and work clothes brought by incoming air passengers who had been associated with rural industries in countries where foot and mouth disease exists, continued. Some 3,678 pairs of shoes were disinfected and 11 clothing articles detained for laundering; from 2,143 passengers.

Clearance of Service Personnel

A quarantine officer accompanied Customs Officers interstate on one occasion to board naval vessels returning with Australian Army personnel from overseas; to clear them for immediate disembarkation at Sydney.

All naval vessels returning to Sydney from exercises overseas were visited and the crew baggage was examined.

Parcels Post

The volume of goods arriving from overseas by parcels post and subject to quarantine control remained considerable. Centres of introduction were Sydney, Newcastle, and Port Kembla. Many items of exotic food of animal origin were seized. The more significant seizures were 2,091 lb meat, 165 lb cheese, 186 lb trahana, 320 eggs, and 249 lb noodles.

Under strict quarantine control a number of trade samples of normally prohibited materials were imported for analytical examination, to enable local manufacturers to study and keep abreast of overseas developments.

False labelling was still evident, particularly with goods from Asian countries. Misleading Customs-declarations added to the difficulty of discovering prohibited materials.

Supervision of Ships' Pets

Supervision of pets on overseas vessels visiting Sydney and Newcastle remained strict. On a number of occasions ships' officers had to be directed to tighten their precautions against escape. This year no Ship Master's bond had to be estreated because of a loss or escape.

Export of Animals

Control over export of animals involved inspection and sometimes supervision of treatment as required by an importing country.

Exports of day-old chickens showed an increase for the first time in 5 years, because of increased exports to Pacific Islands and New Zealand. Horse, cattle, cat, bird, and zoo animal exports also increased. Sheep exports notably decreased, as no large shipment was made. Fish and swine exports also decreased.

Dog exports again increased, continuing the trend of recent years. Dogs were consigned to 45 countries and totalled 3,298 animals; a 75 per cent increase. Some 972 went to the U.S.A., 604 to Japan, 417 to Indonesia, 376 to Hong Kong, and 285 to New Zealand.

Livestock Health—Research

VETERINARY RESEARCH STATION, GLENFIELD

Virus Studies

Calf testis, foetal calf kidney, lamb testis, pig kidney, foetal mouse fibroblasts and a number of cell lines were prepared. Output was as high as 2,000 tubes per week. Procedures generally depended heavily on revival of cells from frozen stocks; work that was handicapped because low-temperature storage facilities were not yet completed.

Brucellosis (*Cattle*)

All strains of *Brucella spp.* isolated from field material are being submitted, for biotyping, to the World Health Organisation Brucellosis Reference Centre, Melbourne. Brucella vaccines, both strain 19 and strain 45/20 were examined for potency, safety, and purity. Further work was done on a rapid whole-blood plate agglutination test, as large-scale testing arising soon from the official Brucellosis Control Programme is anticipated.

Pneumonia (*Sheep*)

Investigations into genetic aspects of susceptibility were continued, in co-operation with animal-production research officers. Besides inter-breed susceptibility-difference between Merino and Border Leicester there appeared to be substantial differences between Border Leicester strains. Flocks of "susceptible" and "resistant" Border Leicester strains were established for further investigations.

Helminthiasis (*Cattle*)

In this continuing project supported by the Australian Meat Research Council the object is to determine seasonal patterns of worm infections and their economic significance; towards formulation of soundly-based methods of control. The "seasonal pattern" and "problem definition" phases have been done on properties in various parts of the State; using body weights, faecal examinations and worm-counts as the main parameters.

This year, that information was supplemented by studies on availability of strongyle larvae on pasture. Additional information on incidence and importance of liver fluke infections in cattle was obtained by including extra trial-properties in enzootic areas.

This year's observations confirmed earlier findings regarding nematode parasites of beef cattle. In most areas, calves made good weight-gains to weaning, and only in nutritional-stress periods did parasites contribute to poor performance. When nutrition was adequate, there was little difference in the performance of untreated calves and those treated monthly with an anthelmintic. Worm burdens in untreated calves were generally low.

Calves on a far south coast dairy farm suffered severe *Ostertagia* infections in November-December, following heavy rain. Several deaths occurred in trial groups before anthelmintic treatment achieved control. Concurrent *Dictyocaulus*, *Cooperia*, and *Nematodirus* infections contributed.

The phenomenon of arrested larval development in *Ostertagia* infections was seen again on several properties. In the New England area the peak numbers of arrested larvae were in early summer in yearling cattle. In other areas the peak was a few months later.

The onset of arrested development on one New England property coincided with a sharp increase in larval numbers on pasture in the spring, and a management programme was evaluated. In this, grazing of contaminated pasture was avoided at times of high larval prevalence. Cattle were drenched once in August and moved to pasture that had not been grazed by cattle for 8 months. Body weight changes and worm counts were compared with those in cattle also drenched in August but remaining on the contaminated pasture.

In the 4 months to December, the moved cattle gained 185 lb per head, compared with 167 lb for controls; and worm burdens included only 7,000 larval *Ostertagia*, as against 70,000 in controls.

Helminthiasis (*Sheep*)

Incidence and importance of nematode burdens in lambs on irrigated pasture were investigated. Lambs receiving monthly anthelmintic treatment made better weight gains than untreated lambs, but a check in growth-rates of both groups occurred in the November-January period. The check was associated with nutritional stress at high stocking-rates (generally 30/acre, but intermittently up to 100 or 175/acre for short periods). *Nematodirus* and *Trichostrongylus* burdens, pneumonia, and a scouring (sulphadimidine-responsive) also caused ill-thrift in that period.

Work with strains of *Haemonchus contortus* and *Trichostrongylus colubriformis* showing resistance to the benzimidazole anthelmintics was continued. Laboratory infections of these strains were titrated against the anthelmintic parbendazole. The anthelmintic efficiencies of clioxanide and rafoxanide were compared, against mature *Haemonchus* (of a benzimidazole-resistant strain). Adult *Haemonchus* burdens were removed by clioxanide at 20 mg/kg and by rafoxanide at 5 mg/kg.

Fascioliasis

Two Goulburn properties experienced losses in sheep from acute fluke disease, due to the larvae of *Fasciola hepatica* in the autumn. Observations were made on total fluke burdens in affected animals, and on the efficiency of the anthelmintics clioxanide, oxyclozanide, rafoxanide and Bayer 4059. All of the anthelmintics showed high activity against immature parasites, but the need for follow-up treatment in animals with massive fluke burdens at the time of first treatment became apparent. In further studies, clioxanide and rafoxanide at the recommended dose rates were found highly effective against immature and mature *Fasciola hepatica* in sheep.

Some lambs and calves were infected to reproduce acute, chronic and low level fascioliasis. Biochemical, haematological, and parasitological observations were undertaken to determine parameters useful in field diagnosis and prognosis. Elevations were recorded in some biochemical parameters but were not large enough to be of specific diagnostic value. A marked eosinophilia occurred in all infected animals. This was generally greater in calves than in sheep, and was directly related to level of infection in each host.

The snail *Lymnaea tomentosa* was successfully maintained and used to produce metacercariae of *Fasciola* for various investigations. The incidence and importance of liver fluke infection in young beef cattle were studied on 6 trial-properties. Results so far indicate very light infection levels. Work to determine the epidemiology of fascioliasis under irrigation conditions has been started.

Contagious Ecthyma (*Sheep*)

Material from all specimens submitted for examination for contagious ecthyma virus was examined by transmission trial and by electron microscopy. Results were entirely consistent. This infection of sheep was also used as a model system for electron microscopy of tissues.

Poultry Diseases' Incidences

Marek's Disease and leucosis (6·3 per cent), chronic respiratory disease complex coccidiosis (2·9 per cent), and tuberculosis (2·7 per cent) were the most frequently recorded diseases. Incidence of infectious bronchitis-nephrosis (1·5 per cent), avian encephalomyelitis (0·8 per cent), and fowl cholera (0·4 per cent) were much less than in 1968–69.

Osteomyelitis, osteodystrophy and other musculo-skeletal abnormalities were noted as causes of leg weakness in broiler chickens, *Staphylococcus* was isolated from cases of osteomyelitis.

Infectious Laryngo-Tracheitis (ILT)

Further trials, done in co-operation with other members of the study group examining various aspects of ILT, included a dose-response trial using SA_2 vaccine *via* the conjunctival route, and two comparative trials of the virulence, immunogenicity and safety of several mild ILT vaccine isolates. A drinking-water dose-response trial using a purified SA_2 vaccine has been planned.

The Minimal-Disease Poultry Flock

The existing flock was sold for slaughter. A serological survey had shown the birds to be free from *Salmonella pullorum* and Newcastle disease, but some reacted strongly to the serum plate agglutination test for *Mycoplasma gallisepticum*. All old litter was removed, and the shed was thoroughly cleaned and disinfected, and spelled for 1 month before a new flock of pullets free of *S. pullorum* and Newcastle disease was introduced.

Avian Encephalomyelitis

Using the Van Roekel strain of virus, the embryo susceptibility test was done on fertile eggs supplied by several hatcheries. Of 23 consignments, comprising 42 batches of fertile eggs, only a small experimental-flock was found susceptible.

Broiler Mortality Survey

From a nutrition trial done in two controlled-environment sheds at the Poultry Research Station, Seven Hills, 441 birds were autopsied. Starvation-mismanagement, and yolk sac infection-septicaemia were the main groups of conditions causing mortality from 0–3 weeks. Infectious bronchitis—nephrosis, perosis, and other leg-weakness conditions were the main causes of loss from 3–8 weeks. There were also significant losses of birds that were in apparently good condition. Bacteriological findings in these birds were negative.

Rabbit Control

Two trials compared one-shot oats and conventional oats as rabbit-poisoning methods on grazing country, and 2 trials compared pellets and carrots as suitable rabbit baits in forest country.

A circular to the Pastures Protection Boards offered analysis of rabbit-breeding data to be collected by their officers. The project will provide better knowledge of the breeding season for rabbits in particular districts.

Fox Research

The survey for *Taenia ovis* infection was continued. Some 300 specimens were obtained. So far, only about 50 have been analysed.

Dingo Research

Dingoes were tagged and released in a study area on the south coast. The CSIRO has joined this study. CSIRO personnel frequently visited the area, and laid the framework for the intimate population-study.

For a genetic blood-parameter survey in *Canidae*, the collection of whole blood from various species of the family was started. The blood specimens were processed by one of the staff of the School of Human Genetics, University of New South Wales. This initial work should be a foundation for an intensive study of the possible geographical genetic-differences in dingo populations. Over 100 specimens were collected for this survey.

The Rabbit Control Advisory Committee decided that organization of dingo baiting programmes (using 1080 poison) should be looked into. Two aerial drops were added. Also some work on the ground concerning 1080 content of baits and the fate of baits, has been initiated. A research officer of the National Parks and Wildlife Service has organized some of the work.

Biochemical Parameters in Sheep

This project is supported by a grant from the Wool Research Trust Fund. The object is to establish the normal pattern of biochemical and haematological parameters in sheep, and then establish changes in defined disease/malnutrition situations. By establishing data critical under local conditions, the value and practicability of diagnostic techniques may be assessed.

An atomic absorption spectrophotometer was installed for determination of calcium, magnesium, sodium, and potassium. The technique for copper determination is under examination.

Sampling of the normal base flock at Trangie was completed. The majority of analyses and haemotological determinations (approx. 20,000) were completed. Detailed studies were made of pregnancy, the newly-born lamb, and ovine haemotology. Disease situations so far studied include fluke and worm infestation, pregnancy toxaemia, and vibriosis; and sera from numerous conditions occurring in the field have been examined.

Vitamin A and E

Methods-development continued, with special attention to alternative means of tissue-preparation and extraction. Serum- and liver-analyses have been done, with normal and deficient sheep from a drought-feeding experiment. Catle, pig, and poultry specimens received for diagnostic work have also been studied.

A colorimetric method for vitamin A was developed. A reagent which has had little previous attention was used. The preparation is more efficient, toxicity-risk is reduced, and the sensitivity is adequate.

Enzymology

Assessment of the role of serum enzymes in veterinary diagnosis was continued. Modifications of methods and equipment (particularly the installation of a twin beam, temperature-controlled, recording spectrophotometer) increased the efficiency, speed, and practicabilities of examining large numbers of samples.

The likely advantages of glutamic dehydrogenase (GDH) and sorbital dehydrogenase (SDH) have been examined. Because of findings during sheep investigations, the isoenzyme components of serum alkaline phosphatase (SAP) have been studied. This should increase the specificity of diagnostic examinations.

Pimelea simplex (*Desert Rice Flower*)

On circumstantial evidence this plant has been suspected of association with incidence of St George disease in cattle. Although the hypothesis is viewed with reservation, feeding experiments were done. The St George disease syndrome was not reproduced, but the plant was found to be highly toxic to cattle at a single dosage of 1 gm dry-plant equivalent/kg body weight. Smaller quantities administered at intervals produced gastro-intestinal disturbance, but were not fatal. The dried plant was found to retain full potency for long periods.

THE COLIN BLUMER DISTRICT VETERINARY LABORATORY, ARMIDALE

Infertility in Sheep.—Studies commenced on the bacteriology and pathogenesis of *Histophilus ovis* and *Actinobacillus seminis*. The 2 organisms were found to be closely related. Bacteriological, serological, and pathogenicity studies, to distinguish them, have been planned.

Work with isolates of *A. seminis* has started. Pathogenicity for rams and ewes (mastitis) has been demonstrated. Investigation of its pathogenicity for pregnant ewes is proceeding.

Acute Selenium Toxicity.—To determine the lethal dose of orally administered selenium, work was undertaken in collaboration with the University of New England and the Veterinary Inspector, Armidale. The LD 50 in lambs was found to be 1·9 mg ± 1·2 mg of selenium per kg body weight, when sodium selenite was administered in a single oral dose. The LD 50 for a single intra-muscular injection had previously been shown to be 0·455 mg ± 0·002 mg of selenium per kg body weight.

The wide fiducial limits, representing 63 per cent of the oral dose, clearly demonstrate the great toxic-variability of orally administered selenium. This finding is consistent with field observations.

Pathogenesis of White Muscle Disease.—The Laboratory collaborated with the University of New England in some studies basic to an understanding of the pathogenesis of white muscle disease. The effect of cod liver oil administration on muscle tissue in lambs, and of massive injections of Vitamin E on liver tissue in guinea pigs, were studied histopathologically and enzymologically.

Helminthiasis.—Two long-term trials were started, to observe the level of infection in sheep on the western slopes and the value of a strategic drenching programme. One trial involves weaner sheep and the second, ewes.

Studies with strains of *Haemonchus contortus* resistant to therapeutic doses of thiabendazole were continued. Additional, resistant strains were detected. Trials have been started, to determine susceptibility of some strains to the benzimidazole group and to other drugs currently recommended to control haemochosis.

A small field trial was undertaken to determine the efficiency of nitroxynil against adult *Haemonchus contortus* in sheep. Groups of 10 naturally infected sheep drenched with nitroxynil or tetramisole were compared with undrenched controls. Both nitroxynil and tetramisole were almost 100 per cent efficient.

Copper Deficiency Survey.—In this survey, continued from the previous year, liver samples are being collected routinely from cattle slaughtered on district properties under official supervision because of disease. Copper estimations are being done at Glenfield. The analyses will continue until data sufficient to indicate likely copper deficiency areas of the district are obtained.

THE DISTRICT VETERINARY LABORATORY—WOLLONGBAR

Brucellosis in Cattle.—Only 3 more herds were examined this year. Work on this project will be intensified. Laboratory testings in the Brucellosis Survey of Beef Cattle were at a high rate in the latter 4 months of the year.

Dairy Beef Project.—This was done at the Wollongbar Agricultural Research Station. The Laboratory did bacterial counts on milk samples from cows suckled at varying intensities. Multiple suckling did not seem to influence the udder flora greatly.

Internal Parasites in Pigs.—The survey was completed.

CATTLE TICK RESEARCH STATION—WOLLONGBAR

Tick Fever; The Complement Fixation Test

An experiment to ascertain the efficiency of the complement fixation (CF) test for *Babesia argentina* has been conducted over the last 2 years and is continuing.

Twenty-six animals were infected by larvae of 8 New South Wales strains of *Boophilus microplus.* Samples were taken weekly and tested—using antigen prepared from the strain of parasites originally obtained from the CSIRO at Yeerongpilly, Queensland. This strain was used for all antigens prepared for routine testing. The following table lists the results of these CF tests, as percentage of samples showing positives of titres:

Month after infection:

*1	2	3	4	5	6	7	8	9	10	11	12	13	14
Per-cent 100	100	96	92	87	83	81	72	65	56	55	59	55	50

* Third and fourth weeks after parasites seen in blood smears.

Cattle Tick Life History Studies

Studies were continued at Wollongbar (pasture) and at Tabulam (pasture and forest). The field-exposure results confirmed that the winter at Tabulam in some years could be much less adverse to ticks than in other years. For the 22 field-exposures made between April and August there were 16, 10, 8, and 18 successful hatches for 1966, 1967, 1968, and 1969 respectively. All 22 exposures at Wollongbar for the winter of 1969 produced hatches, and the 18 successes at Tabulam compared favourably.

In 1969 the absence of a hot, dry spring and early summer (maximum air temperatures 4 to 7° C lower than in 1968) ensured that all field-exposures at all sites produced larvae. At Wollongbar the average life of larval colonies from ticks exposed from September to January was 58 days; close to the summer yearly average of 61. At Tabulam, however, there was a marked response to a favourable season: summer exposures produced larval colonies with an average life of 41 days on pasture (30 for 1968–69) and 68 days under forest (52 in 1968–69).

Exposing of ticks in humidified containers in Stevenson screens was reintroduced at Wollongbar and was started at Tabulam. In humidified containers there were more successful hatches from winter exposures than on pasture. The results demonstrated that relative humidities on the pasture fall low enough in winter to inhibit hatching.

Cattle Tick Population Studies

An investigation on quantitative aspects of the seasonal production of larvae by ticks exposed on pasture was started at Wollongbar. Fortnightly exposures of 20 engorged adult female ticks were made in each of a number of sub-sites. Larvae were collected by cropping the grass tips whereon they clustered; 2,016 samples were taken.

All parts for the electronic tick-counting equipment were not to hand by the end of June, 1970, but 381 samples which had fewer than 2,000 larvae were counted by eye. The remainder of the samples have been reserved for machine counting. At 30th June, 1970, no data for any period of the investigation were complete and ready for analysis.

Resistance of Cattle to Tick

In collaboration with the CSIRO Division of Animal Genetics a trial was started in April, 1969, with 2 sets of identical twins. This is to compare the development of resistance by stalled cattle subjected to different infestation regimes. One twin of each pair received 1,000 larvae a day, while the partner received 3 doses of 40,000 larvae at 10-week intervals. Both sets of twins then received 39 daily doses of 1,000 larvae followed by 1 infestation of 40,000.

All 4 animals, Jerseys and Jersey x Guernseys, developed a very strong resistance to ticks. They maintained this through 3 months of daily infestation of 1,000 larvae in the field.

A second trial was started in April, 1970. This is to determine whether identical twins respond equally to tick infestations. The regime was 1,000 larvae a day, and 2 sets of twins were used. The small variation in daily production of ticks and average tick-weight suggested that the response was in fact equal but, as the investigation was not finished, the data have not yet been submitted to statistical analysis.

Head Wetting During Dipping

It had been accepted that incomplete wetting of heads could allow viable ticks to escape dipping. Two trials at the Cattle Tick Research Station showed that head-spraying as an adjunct to dipping did not improve the already very efficient programme for movement to clean country (3 treatments within 14 days), though the efficiency of 1 treatment was improved. In another trial a rough facial-squirt proved to be as good as thorough spraying of the whole head: perhaps the inside of the ear should no longer be regarded as a problem area.

Despite these results a number of devices designed to improve head-wetting were examined. A high take-off was tested and so was manual dunking of heads. Neither method improved on the standard dipping of cattle on the Station. But then a survey of Board of Tick Control dipping in the Bangalow area showed that about 40 per cent of cattle evaded complete immersion; light breeds (Jerseys and Guernseys) were the worst offenders.

On the chance that an appreciable improvement in head-wetting of old dairy cows during dipping might be possible, a herd of Jersey cows was obtained and especially "artful" dippers were selected. This was for a trial to compare: 3 treatments of standard dipping, dipping with head-spraying, dipping plus head-dunking, and dipping from a high take-off. The results revealed no significant difference between methods.

The conclusion drawn from all these investigations was that the 3-treatments system could not be guaranteed to clean cattle completely—whether their heads were properly wetted or not; very occasionally 1 or 2 ticks would survive.

Eradication of Cattle Tick

In December, 1969, a trial was started to determine whether within 12 months ticks could be eradicated from heavily infested pasture by dipping cattle every 21 days. A paddock of 43 acres was stocked with 30 dry cows; the normal rate within the quarantine area. The acaricide was ethion.

The degree of pasture infestation was estimated by visual assessment of specified areas on the cattle before each dipping, and by including 2 bait-cattle in the area after each dipping—for the period between dippings. By 30th June, 1970, there were very few larvae left in the paddock. Complete eradication by December, 1970 was confidently predicted.

Acaricide Residues

In May, 1970, work to gain information on the nature of delnav residue levels was started. A biopsy technique was introduced. This allowed samples, separated by time, to be obtained from 1 animal. It seemed that delnav residues reached a maximum about 3 days after dipping and were eliminated quite quickly from the animal. A further trial, designed to correlate biopsy residue-levels with kidney fat residue-levels was started in June.

Biological Efficiency of Dips

Samples were taken from dips on the New South Wales/Queensland border maintained at double strength dursban (i.e. 0·05 per cent). There was evidence that a chemical analysis was not necessarily an indication of a dip's biological efficiency. It was noted that a number of dips were not at the desired strength.

Acaricide Trials

A relatively new formulation, dursban 24E, was compared with ethion in 3 trials and found to be equally effective against the Wollongbar strain of *B. microplus*.

The acaricidal efficiency of (a) rucide, (b) rucide followed by a swim in water, and (c) ethion, was compared over 3 treatments at 14 day intervals. Against the Wollongbar strain, rucide appeared to be as efficient as ethion. Furthermore, swimming the cattle through water after dipping in rucide did not appear to have any detrimental effect.

Analysis of hair samples from the dipped animals revealed that ethion disappeared very quickly from the animal's coat and so gave little residual protection against larval reinfestation, while appreciable amounts of rucide remained on the animal's coat for more than 14 days after dipping.

Effect of Dipping, on Production

Two trials started in 1968–69 were finalized.

When *a dairy herd* was arranged in 2 groups of precisely equal production and 1 group was subjected to 3 dippings (with a 3-mile walk) at 14-day intervals, and the milk yields per cow were measured, the dipping did not reduce production.

When *a beef herd* was used to examine the effect of 5 dippings at 14-day intervals, with and without a walk of 4·4 miles, no interference with the cattle weights followed from either treatment.

Estimation of Cattle Tick Population

Wharton and Utech (in press) discovered that counts of adult female ticks 4·5-8 mm in length gave a reliable estimate of the number of engorged adult female ticks that would drop the following day. This method of counting "standard" ticks has been used successfully by CSIRO workers to assess tick infestations in acaricide- and resistance-trials.

At the Cattle Tick Research Station, high correlations were obtained between the counts of "standard" ticks recorded by each of 4 observers and the number of ticks dropped in stalls.

Nature of Acaricide Resistance

A biochemical study was made of the enzymes involved in the cattle tick's development of resistance to acaricides. CSIRO workers had previously shown that Ridgelands and Biarra strains of cattle ticks possessed an acetylcholinesterase system insensitive to many of the organophosphorus and carbamate acaricides. To understand how this insensitive enzyme differed from the enzyme of the susceptible strain, so that specific acaricides could be developed for the insensitive enzyme, techniques to extract the enzymes from homogenates of cattle tick larvae needed development.

Using 3 centrifugal forces (1,700 g, 27,000 g, 109,000 g) the homogenates were separated into sub-cellular fractions. Acetylcholinesterase activity was then determined using the substrate acetylthiocholine iodine. It was found that only 10 per cent of the cholinesterase activity was actively soluble. Of the remainder: 20 per cent was bound to the mitochondria and 70 per cent to the microsome fraction.

These percentages were the same for susceptible and resistant strains although the total activity was less in resistant strains. Several methods were tried to bring about the release of the enzyme bound to the mitochondria and microsomes. Although some success was achieved with the mitochondrial fraction, none of the methods were of any use with the microsomal fraction.

With ultrafiltration techniques the natively soluble cholinesterase was concentrated, and the resultant preparation was applied to polyacrylamide gels. Subsequent electrophoresis showed that this acetylcholinesterase preparation from susceptible strains consisted of at least 3 iso-enzymes, all acting as cholinesterases but differing in either physical or chemical structure.

CATTLE TICK RESEARCH—BOARD OF TICK CONTROL LABORATORY

Pesticide Residues

Organo-phosphates.—Analyses for delnav and ethion were done on 1,200 butter samples from factories and 1,120 fat samples from abattoirs in Tick Quarantine Areas.

Residue levels found were significantly lower than in the corresponding months of 1968–69 The reduction was assumed related to amount of organic phosphate deposited on the animal at each dipping. That amount is measured each time a dipping bath is analysed, by a hair-dunking test. Arbitrarily, 4 mgm per gm of hair is the level at which action is taken to reduce the depositing powers of the bath.

Reduction of the number of dipping-baths that deposit in excess of 4 mgm per gm on the animal's hair could reduce the residue-levels in meat and dairy products. Reduction in the residues in meat and dairy products had been observed, so dipping-baths were surveyed to see whether there were fewer baths depositing excessively. The survey revealed a reduction of up to 90 per cent. Dipping–baths in all areas except Mallanganese and Woodenbong showed a reduction.

Hexachlorobenzene.—Hexachlorobenzene in pig fats was surveyed, over the whole of New South Wales; 97·5 per cent of the 116 samples analysed contained it.

Toxicity of Organic Phosphates

Death caused by organo-phosphates dip poisoning appeared to be more accurately pinpointed this year than in previous years. The number of marginal cases was much reduced. Last year there were 27 cases whereon it was possible to make a positive recommendation, whereas this year there have been only 9 such cases. The estimation of organo-phosphates residues in rancid fats also has now been made possible by an improvement of methods. Thus all fat samples submitted to the laboratory, whether rancid or not, are now analysed for organic phosphates.

Work is being done by the Laboratory and the Cattle Tick Research Station, the latter having developed a biopsy technique. A collaborative experiment is in hand, on delnav residues in fat of cattle because of dipping. The experiment will involve the Laboratory in more than 300 micro-estimations of delnav residues in the cattle fat.

Chemical Change in Dipping Baths

Following reports of evidence of tick resistance to dursban and, concurrently, of signs of chemical change of dursban in dipping baths, action was taken to analyse all the dursban dips. The analysis was by infra-red and by ultra-violet spectroscopy. The finding was that certain of the peaks in the infra-red spectra, peaks which developed as the dip aged, were due to the fat (present to the extent of about 3 per cent) on cattle hair being washed into the bath by the dursban emulsifiable-concentrate in the dip. The amount of this fat in the bath bore some relation to the total of cattle dipped. The additional peaks bore no relation to the breakdown products of dursban.

There was in fact no proof of dursban breakdown in dips.

Depositing Power of Dip Chemicals

Stripping- and settling-trials undertaken on dips charged with nexagan and dursban showed that the depositing power of nexagan at 0·05 per cent was 4·7 mg/gm of hair, and of dursban at 0·02 per cent was 0·9 mg/gm of hair.

The performance of dursban at 0·025 per cent was found to show a much lower stripping rate than dips charged with 0·05 per cent. This suggested that the depositing power of 0·025 per cent dursban is too low for reliability in field use.

Livestock Production Research

SHEEP RESEARCH—TRANGIE AGRICULTURAL RESEARCH STATION

Selective Breeding of Merino Sheep

Measurements of production characters in successive years, from closed flocks wherein sheep are selected for breeding on one or more characters, provide basic genetic information on Australian Merino sheep. Short and long-term responses to selection also are measured. The knowledge can be used to formulate efficient breeding plans affecting the efficiency of production.

Many experiments aimed at determining the biochemical, physiological or morphological causes of genetic differences in production depend upon the maintenance of these flocks for their supply of biological material. The experiments are being done not only within the Department of Agriculture, but in co-operation also with various universities and CSIRO Divisions.

In 1969–70, measurements of production characters in the various selection and demonstration flocks continued. A result of particular interest from the latest hogget shearing, was the apparent response to selection for clean-fleece weight in the Fleece-Plus flock. For a number of years, little genetic improvement in fleece weight in this flock had been observed—indicating probable attainment of a selection "plateau".

There was evidence of fleece rot in the sheep this year, in the wet seasonal conditions, so opportunity was taken to assess fleece-rot incidence in each of the flocks. Strong relationship between fleece-rot and the amount of skin fold was in evidence.

The Influence of Selection on Fertility

Reproductive performance of all flocks is measured, and any genetic associations between selected characters and fertility can be assessed. In 2 flocks (the Nucleus and the Selection Demonstration) sheep are selected on fertility characteristics. Fertility of these flocks was higher in 1969 than that of any other. The single character (degree of skin folding) which has previously been shown to be associated with low fertility did not have so serious an affect in 1969 as in earlier years.

Selection Effect on Efficiency of Conversion of Feed to Wool

Experiments in this project have compared the efficiency of conversion of feed into wool in various flocks selected for one or more production characters. In this way, the genetic associations between efficiency and production characters are assessed.

The work in 1969–70 centred on the complete analyses of experiments undertaken in previous years. The major results may be summarized as follows:

(i) Selective breeding for increased and for decreased fold score each depress the efficiency of conversion relative to a randomly bred control flock.

(ii) Sheep selected for increased fleece weight (and that have exhibited an apparent selection plateau) exhibit among them a lowered variability in efficiency and a decreased correlation between efficiency and wool growth rate.

(iii) Selective breeding for fleece weight has not altered the quantity of the substrate (*viz.* sulphur amino acids) primarily limiting wool growth but the utilization of these amino acids has been affected by selection. Between flocks genetically different in wool production, differences in utilization of cystine for wool growth arise in an intermediate metabolic pool of cystine.

Comparison of Lambing Management Systems

This project, started in 1964, involves the comparison of lamb mortality in 2 lambing systems where records are required. In the first 3 years of the experiment, lamb losses were much greater in an "unsupervised" system than the intensive "drift" system. A high proportion of the lamb losses in the "unsupervised" flock was probably due to mis-mothering of lambs when a large flock containing many young lambs was moved and yarded.

Subsequently, the "unsupervised" system was modified so that the ewes were subdivided into 3 flocks according to the expected date of lambing. Since the introduction of this modification, the difference in lamb mortality between the systems has been reduced to 1 to 3 per cent, with an overall 12 to 16 per cent lamb losses.

Fertility Service

The object of this service is to investigate problems of reproductive wastage on commercial properties. In 1969, investigations were done at 11 and in 1970 at 20 properties.

Ram fertility, lamb mortality, and poor reproductive performance of maiden ewes were the most common sources of reproductive wastage, but relative importance of the 3 varied. The major factor reducing overall reproductive performance in the flock could usually be defined, but the fault influencing this factor varied a lot between properties.

Natural Pasture Grazing Trial

This trial was initially to investigate the management and dry-sheep carrying-capacity of natural annual pastures supplemented with lucerne or native perennial pasture. The project involves critical investigation of the effects of management on individual species, particularly barley grass.

Over the last 2 years the experiment has shown that barley grass is suppressed at high stocking rates. In 1969, when high rainfall favoured barley grass growth, particularly at low stocking rates, the finding was the unusual: wool production per head increasing with stocking rate. The extent of barley grass seed infestation is thought responsible for this relationship.

The results also indicated the advantages of lucerne pasture being available, at lower stocking rates; as sheep can be moved from the barley grass-dominant natural pastures to lucerne—thereby minimizing grass seed infestation.

Drought Feeding

A series of experiments was designed to investigate the value of different protein meals and grains when drought-feeding Collinsville, Bungaree, or Peppin Merino ewes. This work included an investigation of the effect of formaldehyde-treated protein meals in drought rations.

Sheep fed oats produced 30 per cent more wool than sheep receiving wheat. The greatest response in wool production to a protein meal came when diets contained 25 per cent cottonseed meal. Formaldeyhde-treatment of cottonseed meal gave no response in wool growth, in any of 3 experiments. An economic analysis of these results is proceeding.

Selection and Management Practices in Relation to Carcass Characteristics

This new project aims to evaluate selection and management procedures in prime lamb production, in terms of anatomical changes in the carcass. The investigations will provide basic information on the growth and development of sheep from genetically diverse flocks under various conditions of management. From the results, the value of animals as meat producers may be more adequately defined.

SHEEP RESEARCH—CONDOBOLIN AGRICULTURAL RESEARCH STATION

Border Leicester Improvement

Fixed, half-bred Border Leicester x Merino ewes and their ewe progeny have been successively joined to Border Leicester rams, such that flocks with varying proportions of Border Leicester genes are available. Within this project an experiment to examine the effect on lifetime production of first joining ewes at 7 months of age was commenced.

From the 1969 lambing, there was little difference in reproductive performance between comparable groups of ewes containing 75 or 88 per cent Border Leicester (BL) breeding, although there was a slightly higher survival of lambs from the 75 per cent BL ewes. When 75 per cent BL ewes were first joined at 19 months, they produced slightly more lambs than those first joined at 7 months, but this advantage was offset by lower lamb-survival. A high proportion of the ewe lambs joined in 1970, particularly amongst the twins, were served by the rams.

Selective Breeding of Merino Sheep

Selection for weaning weight in Merinos was shown to increase weaning weight relative to randomly selected Merinos. Sheep with a high weaning weight may be particularly suited to prime lamb production.

In this experiment, the performance of the crossbred progeny of Merino flocks selected for high or low weaning was compared when the Merinos were mated to Border Leicester rams in the first cross, and to Dorset Horn rams in the second cross. The results indicated that the superiority of high weaning-weight Merinos is halved with each generation of crossbreeding.

SHEEP RESEARCH—COWRA AGRICULTURAL RESEARCH STATION

Genetic Predisposition of Sheep to Pneumonia

Pneumonia incidence in flocks of Border Leicesters from different genetic sources is being studied. Results from lambs slaughtered in the hybrid-vigour experiment indicated that crossbred lambs showed fewer lung lesions than would be expected if they were intermediate between the parent Merino and Border Leicester breeds.

Three small Border Leicester flocks from different genetic sources lambed together in spring 1969, and the male progeny were slaughtered at about 6 months of age. Examination of the lungs showed that fewer lambs from one flock were infected with pneumonia.

Two more flocks (crossbred origin) have been established; 1 containing 75 per cent and the other 94 per cent Border Leicester genes. A major problem facing the project is the identification of pneumonia in the live animal. Further work is being done with serological tests and X-ray techniques to overcome this.

Hybrid Vigour in Lamb Production

The importance of hybrid vigour in crosses between Border Leicester and Merino sheep is being investigated. Merino and Border Leicester rams were mated to ewes of each breed, from 1963 to 1967 inclusive. The wether progeny were slaughtered while the ewe progeny were retained to be joined to Dorset rams for 5 years.

Results of the first phase indicated that heterosis effects on prenatal ova wastage in the base ewes were slight, but were of the order of 10 per cent for lamb survival and growth. Heterosis effects were apparent for all measures of reproductive performance. This was further substantiated by results of the 1969 lambing. The lower performance of the pure bred ewes was due to a high proportion of Border Leicester ewes failing to lamb, particularly in the oldest and youngest age groups, and a low proportion of multiple births in the Merino.

The 1963 drop F_1 ewes were slaughtered and their reproductive tracts and lungs examined for abnormalities. Samples were taken for histological examination. There appeared to be no gross abnormalities in the reproductive tracts. The proportion of normal lungs ranged from 30 to 40 per cent, for each of the 4 breed types.

Selective Breeding of Border Leicester Sheep

The Border Leicester stud flock at Cowra is being enlarged. When a sufficiently large gene pool is available, single character selection flocks will be formed. These flocks will be used to obtain information on the genetic parameters effecting production of Border Leicester sheep in Australia.

Of the 3 selection flocks, 1 will be selected for growth, 1 for fertility, and the third will be a random breeding control flock. Each flock will comprise 80 breeding ewes and 5 rams, except that the random flock will use 20 rams.

Selective Breeding of Dorset Sheep

Dorset studs (Horned and Polled) are being established at Cowra. When a sufficiently large gene pool is available, single character selection flocks will be formed. These flocks will be used to obtain information on the genetic parameters affecting production.

Flocks to be formed will be (i) random, (ii) growth, and (iii) fertility selection flocks within each of spring joining and autumn joining groups. Each flock will consist of 80 ewes and 5 rams, except that the random flocks will use 20 rams.

A part of this project involves the study of difficult births and high lamb-losses. There were higher losses, and a higher proportion of lambing ewes needed assistance, during the spring than the autumn lambing. More detailed observations will be done at the 1970 lambings, with post-mortems on lambs that die during lambing.

Grazing Systems for Lamb Production

This experiment was designed to investigate management systems with sheep on a lucerne/sub clover/ryegrass pasture. The systems involved (a) set-stocking, (b) saving an area for special purposes, (c) rotational grazing, and (d) rotational grazing with an area saved for special purposes.

Set-stocking systems have reverted the pasture to capeweed-domination; the lucerne component having been quickly killed.

In wool growth or body weight of the ewes there was little difference between the management systems for most of the year. In the later years of the experiment, sheep on the set-stocked pasture tended to lower body-weights in late summer. Lamb growth-rates were greatest on set-stocked systems, and there was no advantage by saving 20 per cent of the area. The lower lamb-growth rates under rotation management could be prevented by set-stocking from lambing to weaning, but this killed the lucerne.

SHEEP RESEARCH—COWRA AND GLEN INNES AGRICULTURAL RESEARCH STATIONS

Crossbreeding in Prime Lamb Production

This experiment was to investigate various combinations of the Merino, Border Leicester, and Dorset Horn breeds, for prime lamb production. At both the Cowra and the Glen Innes Agricultural Research Stations, a flock of Merino ewes was divided at random into 3 groups and each was joined to Merino, Border Leicester, and Dorset Horn rams respectively, in autumn 1964 and 1965. The wether progeny were slaughtered. The ewe progeny were mated to Border Leicester and Dorset Horn rams.

Production of the ewes is being measured over a period of 5 joinings. Half the ewes of each breed are joined during the spring and the other half during autumn.

The 1969–70 results support those of previous years: little difference in reproductive performance between the Dorset Horn x Merino and Border Leicester x Merino ewes when joined in the autumn, and both superior to the Merino. The Dorset Horn x Merino ewes were superior in reproductive performance following a spring joining, and this was due mainly to a higher proportion of the Dorset Horn x Merino ewes lambing. Wool production from the Dorset Horn x Merino was below the other 2 breeds, but its crimp frequency is higher than the Border Leicester x Merino.

SHEEP RESEARCH—LEETON AGRICULTURAL RESEARCH STATION

Autumn-Winter Nutrition of Breeding Ewes, on Irrigation

Production of autumn-lambed ewes, stocked at 4, 6, and 8 to the acre were compared under different pasture-management systems on irrigation. The value of incorporating areas of summer pasture (paspalum-white clover) and/or sod-sown oats into a basic farmlet of subterranean clover-wimmera ryegrass was studied. The experiment was begun in October, 1966 and ended in February, 1970. Detailed records of ewe, lamb and pasture production were obtained.

Results showed that 8 ewes/acre was too high a stocking level for production of prime lambs under the systems examined. Both 4 and 6 ewes/acre were carried set-stocked on winter pasture (sub clover-wimmera rye) for 3½ years and gave satisfactory production of wool and lamb.

Use of summer pasture at 4 and 6 ewes/acre was wasteful. At 8 ewes/acre, wool production was increased by 0·7 lb/head when ¼ of the farm area was sown to summer pasture. However, the overall level of production at this stocking level was too low for commercial consideration. Lamb growth rate was decreased at all stocking rates by the use of summer pasture, because of associated reduction in winter-feed availability.

Use of sod-sown oats was of little benefit in terms of animal production, although slight increases in pasture production were noted. An unexpected result was an increase in wool production by 0·9 lb/head at 4 ewes/acre with ¼ of the farm area sown to oats. This did not occur at 6 or 8 ewes/acre. Lamb growth rate was not improved by the use of oats.

Border Leicester—Merino, Merino, Cheviot—Merino Comparisons

Border Leicester-Merino, Merino and Cheviot-Merino ewes (bred from a common flock of Merinos) are being compared as prime-lamb mothers, under irrigation conditions, when mated to Dorset rams in either spring or autumn.

Results for the 4 years to 1968 showed the Border Leicester-Merino ewe to be superior to the Cheviot-Merino in terms of fertility, lamb and wool production, and to the Merino in lamb growth, carcass quality and number of lambs dropped from an autumn joining. Wool production from Border Leicester—Merino and Merino ewes was similar, while price per pound of wool and the number of lambs dropped from spring joining were greater for Merinos.

Results for 1969 largely confirmed the previous results except that the premium paid for Merino wool was less than in 1968. Gross returns per ewe joined, for Border Leicester-Merino, Merino, and Cheviot-Merino ewes in 1969 were: (a) *Autumn joining:* $10.00, $7.99, and $7.05 respectively; (b) *Spring joining:* $6.76, $7.85, and $5.97 respectively.

Five years results have demonstrated that the Cheviot-Merino ewes under observation have been relatively uneconomical as prime-lamb mothers; because of low fertility, particularly lack of twinning, and lower wool production.

Start of the Breeding Season in Border Leicester-Merino Ewes

This experiment was done to determine the effect of nutrition during winter and spring on the start of the breeding season of Border Leicester-Merino cross ewes. Two nutritional treatments were applied: best pasture available *versus* pastures with limited feed availability—from May to mid-December when the ewes were maidens and from July to mid-December in the next year. No treatment was applied in the third year. Rams were introduced on 1st October each year.

In the first year the fertility of the ewes on the limited pasture was depressed, probably a puberty effect. In subsequent years, it was apparent that nutrition was only a modifying factor and that previous lambing-performance was more important. Ewes that had lambed previously started mating 8 weeks earlier than nonparous ewes. Body-weight within any group was not a significant factor.

Time of onset of the breeding season advanced with each year of the 3-year experiment.

SHEEP RESEARCH—TEMORA AGRICULTURAL RESEARCH STATION

Breed Comparison Trial

Five breeds have been compared under similar conditions of management: the Peppin Merino, "Bungaree" South Australian Merino, the fixed Border Leicester x Merino half-bred (BLM), the Corriedale, and the Polwarth. Results from the latest lambing (1969) contain the first fully-comparable figures from ewes bred within the trial. Reproductive performance of the BLM ewes was 25 per cent superior to that of the Corriedale ewes; the latter's reproductive performance was greater than those of the remaining breeds.

Control of Blow Strike by Management

This trial aims to determine whether management can protect a Merino flock from fly-strike. Fly-strike incidence is recorded in each of 3 groups of lambs; all mulesed. The treatments then compare the effects of lamb shearing, no lamb shearing and jetting. A smaller, fourth group of lambs is not mulesed and serves as a control group to indicate fly activity.

Early results indicated that: mulesing is largely effective in preventing breech strike; jetting is effective when blow fly activity is high; but lamb shearing does not effectively prevent either breech or body strikes.

Stocking Rate and Superphosphate Application, on Productivity of Merino Ewes Grazing Improved Annual Pastures

Effects of superphosphate on sub clover-ryegrass pastures at 3 stocking-rates was investigated. The grass component of these paddocks increased with increasing superphosphate application. Changes in pasture composition had little effect on animal production over the past year.

Reproductive performance of the ewes was satisfactory, with all treatments except for ewes stocked at 4/acre on pasture receiving 0·75 cwt superphosphate. The latter treatment was characterized by a pasture of low-quality barley grass for part of the year.

Co-operative, Drought-Feeding Experiments

An experiment was designed to evaluate cottonseed and cottonseed meal as a supplement for drought-fed sheep. Sheep fed a control diet of hay had significantly lower body-weights and wool growth than those receiving either cottonseed or cottonseed meal. When fed at the same nitrogen intake, sheep fed either cottonseed or cottonseed meal had similar body-weights and wool growth.

In this experiment, a relationship was found between body-weight loss and level of serum glutamate oxalacetate transaminase. This indicated tissue breakdown during adverse nutrition.

Lucerne Grazing Management Trial

The management of lucerne when stocked at either 2 or 4 breeding ewes/acre is being investigated. Comparisons are made between set-stocking and a 5 or 7 paddock rotation with 2 rotation speeds.

The lucerne component of the pasture was eliminated within 6 months when set-stocked at 4 ewes/acre. No production differences were observed in any of the remaining management systems. These included different numbers of paddocks within the rotation, and adjustments to the speed of rotation in different seasons.

SHEEP RESEARCH—GRAFTON AGRICULTURAL RESEARCH STATION

Prime Lamb Production on Lower Clarence River Alluviums

This experiment is designed to study the feasibility of prime-lamb production as an alternative to dairying. Merino and Merino x Dorset Horn ewes are being compared at a particular stocking-rate on naturalized pasture with oats and ryegrass providing winter fodder. Both types are joined to Border Leicester rams in spring each year. Year-round, 4-week drenching is being compared with a programme of strategic and tactical drenching.

Results to date indicate possible superiority of Merino x Dorset Horn ewes as prime-lamb mothers under these experimental conditions.

SHEEP RESEARCH—SHANNON VALE NUTRITION STATION

Production Performances of Poor and Improved Merino Strains under High and Moderate Stocking Rates

In this experiment 2 breeding flocks have been established. One group of ewes is selected for high fleece weight ("fleece plus") and the other for low fleece weight ("fleece minus"). Two flocks of 210 breeding ewes (105 "fleece plus" and 105 "fleece minus") are grazed at different stocking-rates (2 and 6 breeding ewes/acre).

The flocks are stocked at these rates to see if the genetically determined differences in wool production are fully apparent under a high stocking-rate husbandry-system which minimizes fleece cut per head.

A secondary object of the trial is to highlight any difficulties which may be encountered when grazing a breeding flock at a high stocking-rate. Effect of stocking-rate on growth of weaners and reproductive performance of ewes is expected to be an important outcome of the trial.

At the 1969 lambing there were big significant differences between stocking-rates, in number of ewes lambing (high 72·9 per cent; low 95·7 per cent) and of lambs born alive (55·7 per cent; 93·4 per cent). The advantage in wool production of the "fleece plus" ewes showed a small decline, from 47 per cent at 2 ewes/acre to 40 per cent at 6 ewes/acre.

SHEEP RESEARCH—TAMWORTH AGRICULTURAL RESEARCH STATION

Dorset Horn versus Border Leicester Merino Ram

The object is to examine the value of crossbred rams and to determine if mature body-weight is useful as a selection criterion for prime-lamb sires. Sires with heavy, medium, and light mature body-weight, of each breed, were separately mated to groups of 45 first cross ewes. Carcass weights and body-weights of all progeny were measured.

In 1969 there was a significant effect of breed of ram on both live weight and carcass weight of progeny. Carcass weights were: Dorset Horn 41·2 lb; Border Leicester-Merino, 33·5 lb. The body-weight of sire had an effect on carcass weight of progeny (regression coefficient of 0·10) but breed was much more important than the sire weight.

SHEEP RESEARCH IN CO-OPERATION WITH DISTRICT LIVESTOCK OFFICERS

Lifetime Performances of Single versus Twin Born Merino Ewes

In a number of private flocks, single and twin-born ewe lambs are being identified as soon after birth as possible and thereafter run together. Body-weights are recorded at marking, weaning, and before mating each year. Body dimensions are recorded at weaning and before the 2-tooth mating. Fleece-production and fertility data are being recorded annually.

Differences in body dimensions between single and twin-born ewes disappeared between 12 and 18 months of age, and there have been no differences in fleece-weight after the 18 month shearing.

Reproductive data are still scant. No differences were had in lambing percentages between the 2 groups of ewes in the 2 cases where data for 1969 are available.

Ram Percentage Comparisons

In 1969 the effect of ram-percentage on flock fertility was studied on a number pf properties. On each property, groups of 200 ewes were joined to 1 per cent or 3 per cent of rams. With mature ewes, earlier results were confirmed; i.e. 1 per cent of rams reduced flock-fertility very little. One exception was recorded, where 50 per cent of ewes in the 1 per cent group failed to lamb. This appears to have been an atypical result, in light of the bulk of observations since 1967. But it may indicate a real hazard in using such a low ram-percentage, particularly when joining in a hot environment.

Where mature and maiden ewes were joined together there appears to have been a failure of rams at 1 per cent to serve all the maidens; possibly because of competition from the mature ewes for the attention of the rams, or because of shorter duration of oestrus in the young ewes. Further trials with maiden ewes are being conducted in 1970.

SHEEP RESEARCH—YASS VALLEY

Farm Management, Development Problems

This project continued as an investigation into alternative strategies for management and development of district properties. The study is in two broad sections:

(i) Collection and analysis of farm records from co-operating properties; these providing a realistic basis for assumptions.

(ii) Preparation of linear programming models to determine the optimum whole-farm gross margin in the Yass Valley environment.

Farm records (1968–69) were collected from 6 co-operating farmers. Profit ratios (operating return/total assets) varied from 7·88 to 1·30 per cent. Work has commenced on preparing the linear programming model for a farm in an adjustment situation; i.e. growth-phase largely completed and improvements to come through better management and use of resources. The major difficulty in formulating the model has been the accurate definition of the pasture/animal relationship.

SHEEP RESEARCH—CSIRO, PROSPECT; CO-OPERATIVE

Importance of the Ram in Flock Reproduction Wastage

The object is to determine the importance of ram fertility on the overall reproductive-performance of flocks. In field studies, the subcutaneous scrotal temperatures of 2 freely-grazing rams were monitored over a period of 5 days by means of radio-telemetry. Evidence of heat-loads high enough to cause infertility was found on only 1 occasion. Technical problems associated with the telemetry system were corrected and transmission distance was increased from 250 yards to 1½ miles.

Flocks of sheep mated to ram-groups of which half the rams in the group were infertile were seen to show an average of 15 per cent fewer pregnant ewes.

Pregnancy-diagnosis in sheep (using an Allard Sonicaid V601 foetal blood-flow detector), was found to be associated with a 15 per cent error. This was when the diagnosis was made 100 days after the start of joining, in a flock wherein the length of gestation varied from 66 to 115 days at the time of observation. When the same flock was observed at 134 days after the start of joining the error was less than 1 per cent. Differentiation of single and twin-pregnancies was accurate after 120 days of pregnancy.

BEEF CATTLE RESEARCH—GRAFTON AGRICULTURAL RESEARCH STATION

In-Vivo Estimation of Phosphorus Status of Grazing Beef Cattle

Biopsy samples were taken in May, 1969, from the rib bone of 18 yearling steers grown on improved pastures before their placement on a native pasture area (predominantly carpet grass *Axonopis affinis*). In December, 1969, bone biopsy samples were again taken from the ribs of these steers.

Phosphorus content of the dry, fat-free bone samples taken in December, 1969 (13·49 ± 1·32 per cent) was significantly lower than that of the dry, fat-free bone samples taken in May, 1969 (15·01 ± 1·34 per cent) ($P < 0{\cdot}05$).

The results indicated that the method may be a valuable aid in the explanation of animal production data where phosphorus is likely to be limiting. The method may also be valuable in field diagnosis of phosphorus status of grazing cattle.

Further investigations are under way; examining the response (in the bone, hair, and blood) of grazing beef cattle, to various levels of phosphorus supplement, and relating these to measured parameters of pasture quality.

Nutrition and Reproductive Performance of Beef Cattle

This is a co-operative Division of Animal Industry/Division of Plant Industry project. It was begun in March, 1969; to obtain guiding information on the likely response, in beef cattle production, from pasture improvement of the finer textured soils of the Clarence River Valley.

Three pasture blocks are being grazed, at different stocking rates, by breeding Hereford cows. They are: (i) Native pasture grazed at 3 stocking rates; (ii) Native pasture topdressed with superphosphate and oversown with naturalized white clover, grazed at 4 stocking rates; (iii) Native pasture topdressed with superphosphate and oversown with Ladino white clover, lotononis and lespedeza, grazed at 4 stocking rates.

Calf-production from treatment (ii) at a stocking rate of 1 cow/1·52 hectares, and that from treatment (iii) at a stocking rate of 1 cow/1·21 hectares, have been better than district average; but cow production and pregnancy rates on all treatments have not been as good as those reported by Duncan (1967) from native pastures in the region.

Clearly, the carrying capacity of the pastures under investigation has been over-estimated; since the lowest stocking-rate on each pasture must necessarily be safe enough to assure satisfactory production every year.

DAIRY CATTLE RESEARCH—WOLLONGBAR AGRICULTURAL RESEARCH STATION

Dairy Beef Production

This research project was initiated in 1969, to study supplementary means of animal production on north coast dairy farms. A system based on the multiple-suckling of crossbred calves on dairy cows is being studied, for feasibility of rearing surplus "bobby" calves for beef production. Virtues of the system could include: (a) considerable labour-saving relative to other calf-rearing systems, (b) no outlay of capital to build calf pens or houses, and (c) calves so reared are usually less prone to disease.

Initially, the effects of the number of calves suckled per cow is being examined. From the pre-weaning data it appears that rearing 3 calves per cow offers similar returns to milk production, and a substantial saving of labour. After weaning (12 weeks) calves are grown on nitrogen-fertilized kikuyu grass to an age of 10 months. Until the post-weaning data are available it is not possible to interpret fully the results of the experiment.

Properties of Sub-tropical Pastures which Affect Cattle Production

Work over the past year included milk production experiments, sheep metabolism experiments, and experiments with the technique of *in vitro* digestion.

Milk-production experiments have suggested that Pangola (*Digitaria decumbens*) and green panic (*Panicum maximum*) have the capacity to produce greater amounts of milk than either Setaria (*Setaria sphacelata*) or kikuyu (*Pennisetum clandestinum*). The reasons have been investigated with sheep, and superior digestibility and voluntary intake of Pangola and green panic were found. Superior *in vitro* digestibility and rate of digestion were also found with these 2 species.

An experiment, wherein nil and 6 lb of crushed oats/day was provided to dairy cows, demonstrated that the full response to supplementary feeding of oats can be expected in about 4 days. Experiments with sheep indicated that the increased production had from supplementary feeding was due to an increase in total food-intake. A further experiment, investigating responses to both "energy" and "protein" supplements, is proceeding.

PIG RESEARCH—WOLLONGBAR AGRICULTURAL RESEARCH STATION

General

Pig research was restricted during 1969–70, while the piggery was being converted into a fully intensive unit. The new unit contains much-increased facilities for research. A uniformity experiment was conducted, to examine positional effects in the new grower-pig research building. No positional effect was detected.

Protein Quality Studies

Investigations continued into the nutritional value of New South Wales brands of meat meal or meat and bone meal for growing-pigs.

The experiment done in 1969 indicated that tryptophan and lysine were limiting amino acids in a maize/meat and bone meal diet. This confirmed previous evidence that meat meal or meat and bone meal is each unsuitable as a sole protein-supplement to maize-based diets.

POULTRY RESEARCH—POULTRY RESEARCH STATION, SEVEN HILLS

Breeding Project (Eggs)

The current, egg breeding-programme was commenced in late 1959 when the reciprocal recurrent-selection programme for egg production was ended. It comprises 3 egg-production flocks and 3 corresponding control flocks, namely: *A Flock*—Australorps; *B Flock*—White Leghorns; *C Flock*—Synthetics (a closed population, originally based on both crosses between White Leghorns and Australorps).

Between 2,000 and 2,300 pullets are tested in single-bird cages each year. Selection is done with September-hatched chickens, on egg production to the end of June. The 10th generation is now being tested in the cage house. In recent years an index including both egg-production and egg-weights has been used in the selections. This year, reciprocal crosses were made between the parental lines—giving 6 crossbred and 3 parent lines. These 9 lines will be held for a full 2-years' production, to permit assessment of the feasibility of breeding for an extended laying-period.

Interim results suggest that:

(a) Selection in the synthetic flock has resulted in a faster rate of response (in terms of egg-quality) than selection in either the Longhorn or Australorp flocks.

(b) The cross between Australorps and Leghorns is superior (in terms of egg quantities) to the synthetic flock.

(c) A proportion of the genetic variation for egg-weight and egg-production is sex-linked.

High and Low Protein Meatmeals for Caged Layers

The objects of this experiment were: to compare the productivity of laying-pullets given diets containing high and low-protein meatmeals, and to examine the proposition that low-protein, high-calcium meatmeals are of adequate protein-quality for normal egg-production.

Replacement of meatmeal with meat and bone meal depressed the hen-day egg-production of pullets given diets containing 9 per cent meatmeal. This depression was alleviated by adding soybean meal to increase the total protein. No similar trend was evident in efficiency of feed-utilization. The diets of equivalent calcium-content containing 9 per cent meatmeal or meat and bone meal supported equal egg-production and indicated a possible production-depressive effect of calcium under the conditions studied.

High and Low Protein Wheat for Caged Layers

The protein content of wheat available to the industry in recent years has been extremely variable. An experiment done in 1967–68 compared high- and low-protein wheat in layer-diets. Treatments including commonly used feed-medication programmes were superimposed upon the wheat-quality treatments.

There were no significant effects of wheat proteins or feed-additives on feed eaten per bird per day, on feed required per dozen eggs, or on hen-house egg production. But substitution of high- for low-protein wheat on an equivalent-nitrogen basis significantly depressed hen-day egg-production.

Both wheat protein and feed-additives had significant effects on aspects of egg quality. Substitution of high-protein wheat for low-protein wheat on an equivalent-nitrogen basis reduced egg weight, particularly during the second half of the laying period. But no effect was observed when the substitution was on a bulk basis.

Continuous treatment with furazolidone depressed egg-weight. Substitution of high-protein wheat for low-protein wheat on an equivalent-nitrogen basis increased shell-strength, as measured by egg specific gravity. But no effect of feed-additive was observed.

There was significant reduction in the deterioration in albumen quality, on storage, of eggs produced by hens given high-protein wheat on an equivalent-nitrogen basis to those receiving low-protein wheat. The results demonstrate that high-protein wheat can be substituted for low-protein wheat on an equivalent-bulk basis, without effects on productivity. However, the quality of the protein of high-protein wheat appears to be inferior to that of low-protein wheat for layers.

Daily Feed-intake, and Least-cost Energy-diets for Laying Pullets

High-energy layer-diets may be of value in reducing feed-cost as bulk. If so—handling cost is decreased and cost per calorie of metabolisable energy is decreased, within limits, as the energy content of the diet is increased. However—"overconsumption" of high-energy diets has been observed.

An experiment was begun in December, 1968, to examine the influence of diets of increasing energy-content on daily feed-intake, energy intake, production, efficiency of feed-utilization, and egg quality. The probable over-consumption rate of the diets was calculated, and the protein content in a second set of diets was reduced accordingly. The highest energy diet (3,300 K cal M.E./Kg) was impracticable for *ad lib* feeding, and graded restrictions of feed-intake were applied on a time basis (*ad lib*, and 8 to 2 hours only/day available for feeding). This was to examine a possible method of avoiding over-consumption and the stress-effects of restricted feeding.

Though feed-intake was reduced as the energy-content of the diet was increased, adjustment of daily energy-intake was inefficient and an over-consumption of energy (of about 12 per cent) was observed at the highest-energy level. Daily energy- and protein-intake were minimal, and egg production and efficiency of utilization of energy were maximal, when the diet contained 2,900 K cal M.E./Kg. Reduction of the protein of the diet according to calculated over-consumption, tended to reduce egg-production except on the highest-energy diets where a protein-sparing effect was observed.

Restriction of the time available to feed, for hens given the highest-energy diet reduced feed-intake. But the productivity of hens given 5 hours per day to feed was greater than that of hens given any of the diets *ad lib* and superior to any other group on limited feed-intake.

The results so far suggest that over-consumption may negate any apparent saving in cost with high-energy diets given *ad lib*. However, restricted feeding of a high-energy diet on a time basis appears to be a satisfactory method of control of over-consumption and may have economic merit.

Meatmeal Investigations

Nine samples of meatmeal, of known processing history, were provided by the CSIRO Division of Chemical Engineering, Melbourne, from their studies of the physico-chemical aspects of meatmeal-rendering. Routine samples provided by the CSIRO were similar to average or above-average meatmeals.

Since the conditions needed for degradation of wood fibres are likely to result in damage to other proteins, the influence of modifications to the pressure cycle on meatmeal-quality were examined. However, there appeared to be no relationship between the omission or application of the pressure cycle at the start or end of the cook as regards meatmeal quality. One sample was of particular interest because under normal conditions it would have been considered to be grossly overcooked. Yet it supported the best growth. The results also suggest that the amount of bone or the ratio of hard to soft offal in the charge has an influence on meatmeal quality other than via the calcium of the bone, since the lower calcium meatmeals in isocalcareous diets had a higher growth-promoting ability than the high-calcium meatmeals.

Nutrient Requirements of Turkeys

In 1966–67, optimal growth of Australian white turkeys from 0–6 weeks was achieved with a 32 per cent protein diet. From 6–12 weeks, female poults fed 21 per cent protein grew as well as those on 25 per cent protein. Male turkeys over this period grew more rapidly on 25 per cent protein than those on a 21 per cent diet.

In 1969, Australian White turkey poults (commercial strain) were raised, with sexes separated to estimate protein requirements of each sex. Optimum growth-rate between 2 and 8 weeks for male and female poults occurred at 28 and 27 per cent protein respectively. Feed conversion ratio (2·167 for females and 2·048 for males) was not effected by dietary protein content. There was an indication that males needed 22 per cent dietary protein for optimal growth from 8–12 weeks but females needed only 20 per cent protein in this period. Feed-conversion of females (3·427) was worse than that of males (2·243), and poults on the lowest protein treatment showed markedly lower feed conversion.

Liveweight-gain from 8-12 weeks was better on 24 per cent dietary protein than on 20 per cent. The difference was significant only for the males; thus supporting the hypothesis, from earlier work here and elsewhere, that males require higher dietary-protein for maximum growth.

All birds tended to be heavier on the lower-energy diet. This could reflect a palatability problem, since the higher-energy diets had more fat and the pellets tended to pulverize more than the other diets.

Feed-conversion ratio from day old to 12 weeks (mean = 2·107) was not affected by treatment. Although 24 per cent protein promotes more rapid growth, a 20 per cent protein diet provide the best profit.

Physical Form of Broiler Diets

This experiment investigated the effects of physical factors (energy content and pelleting) on chicken growth. Mean liveweight, at 9 weeks 1 day, was not significantly affected by dietary energy-content. Pelleting improved growth-rate but the effect was less marked when dietary energy-content was high. The dietary treatments had little effect on liveweight of female chickens. Males averaged 1·96 kg (4·32 lb) and females averaged 1·61 kg (3·55 lb).

Feed-conversion ratio was negatively correlated with dietary energy-content. Feed conversion was better on pelleted diets than on mash diets but this difference was significant only for the low-energy treatments.

Environment Control in Broiler Nutrition

This experiment examined stocking-densities of 0·425, 0·45, 0·5, 0·6, and 0·7 square feet/bird in a randomized block, with 4 replications. Waterer-space was the same in each pen, but feeder-space was adjusted for each treatment—to provide 1 inch per bird. A sample of setting-eggs was weighed for comparison with other hatches. Egg weight averaged 60·7 g (2·14 oz) and chick weight averaged 40 g at 1 day of age. All birds received broiler-booster crumbles for the first 3 days, broiler-starter kiblets until 4 weeks 6 days, and then broiler-finisher kiblets to 9 weeks.

Liveweight at 9 weeks was not significantly affected by stocking-density (mean cockerel weight = 1·95 kg or 4·30 lb, mean pullet weight = 1·56 kg or 3·45 lb and mean weight of mixed sex = 1·76 kg or 3·88 lb). Feed conversion was significantly better on the 2 higher stocking-densities (0·425 and 0·45 square feet/bird). These give feed-conversion ratios of 2·365 and 2·296 respectively. This compares with the lower stocking-density treatments which average approximately 2·45 feed-conversion. Income over feed- and chick-cost was positively correlated with stocking-density. Overall shed-mortality was 8·5 per cent, with no apparent treatment-effect.

Under the conditions of this experiment the highest stocking-density provided the best profit (33 cents/sq ft). One confounding factor was that environment was only partially controlled after 5 weeks, due to thermostat difficulties. This could have a profound effect on interpretation of the optimum stocking-density.

Age to Change from Low-Calcium Grower Diet to Layer Diet

Overseas results suggest that dietary calcium should be increased 2 to 3 weeks before point of lay, to promote maximum body-reserves for subsequent demands during laying. Changes were made at 6 different ages, viz. 13, 14, 15, 16 weeks, at 5 per cent egg production, at 10 per cent egg production, in a randomized block design with 2 replications.

Pullets changed to high-calcium diets 3 or 4 weeks before point of lay, at 14 or 13 weeks of age respectively, tended to have larger eggs at 43 weeks of age (26 weeks of lay).

Broiler Breeding Programme

The ninth selected generation of the broiler-breeding programme was hatched during November and December of 1969. A randomly-selected control-flock mating was done at the time of the selected-breeder matings. The selection flocks are maintained; an E and a D flock. The E flock is the more advanced line, while the D flock is to be used later as the female line.

Disease problems made genetic evaluation difficult. This has been a feature of the programme over the recent years. It is expected to be eliminated when the new controlled-environment sheds are completed. The new sheds will be used for the generation starting in November of 1970; with 4 fortnightly hatches, by splitting each shed in 2—using polythene curtains.

Relatively low gains were made this year, probably because of the high disease-incidence in 1969. Thus, birds selected as being the heaviest at 9 weeks of age were in most cases those which did not show overt symptoms of the disease. In other words, selection was to a certain extent for disease-resistance rather than for genetic ability to grow well under a moderately disease-free environment.

Genetic Correlation Between Feed Conversion and Growth Rate in Broiler Chickens

Feed accounts for about 70 to 80 per cent of running costs in broiler-production. Thus, a small saving in feed per bird, without corresponding drop in growth rate, can mean a very large saving in costs—taken over a year.

To examine the possibility of improving feed-conversion through selection, 3 selection lines have been established: an increased efficiency line; a decreased efficiency line; and a control line. Detailed individual measurements are made to 4 weeks of age. Subsequently performance from 4 to 9 weeks and body-composition of a sample at 9 weeks have been noted.

Realized heritability- and genetic-correlations between feed-conversion and growth rate have been calculated. Correlations between initial and subsequent performance on a group basis, and correlations of feed conversion and growth rate with body-composition characters have also been calculated.

The realized genetic-correlation measured after 2 generations of selection was —0·52. Using this value and the realized heritability-value for feed-conversion rates of 0·386, together with the base population estimate of 0·30 for the heritability of growth rate, direct selection for feed-efficiency was estimated to be twice as effective in improving efficiency as was selection for growth rate. Some form of direct selection for efficiency is therefore indicated.

Because of difficulty in measuring consumption on an individual basis, sire-family selection for efficiency is suggested. Sexed sire-families can be split into replicated groups and run on deep litter; measuring the feed consumption. Individual weights at 9 weeks can be measured without difficulty. Using the parameters obtained from the experiment, *a selection index was formulated* for incorporating feed-efficiency and growth rate in a selection programme to maximize economic progress. The index simplified to: X — 130 Y (where "X" is the 9 week weight, and "Y" is the sire-family average F.C.R.).

The chickens with the highest index are the selected parents of the next generation.

Body Composition and Feed Efficiency of Broiler Chickens

Broiler chickens (120) were reared from 8 to 29 days of age in single-bird cages located in an air-conditioned room held at 24° C. Each cage was provided with a separate feeder. This enabled feed consumption to be measured individually. Weight-gain over the period was measured and the feed-conversion ratio was calculated. The chickens were then slaughtered and measurements of body-composition were made.

Detailed studies of the relationships between various growth- and carcass-characters have shown that the more efficient male chickens at 4 weeks therefore grew faster; had relatively smaller viscera; lower per cent protein, ash and water, and higher per cent fat in the carcass, than the less efficient chickens. There would appear to be a positive relationship between feed-efficiency and degree of feathering in the female chickens at 4 weeks of age.

Livestock Production—Field Activities

SHEEP AND WOOL SECTION

Staff

Numbers.—The Section's establishment strength at 30th June, 1970 provided for 51 Livestock Officers (Sheep and Wool). The 51 include 1 officer seconded to Division of Research Stations as Manager, Trangie Agricultural Research Station, 1 seconded to the National Parks and Wildlife Service, and 1 on National Service, and 1 vacant position.

There are 23 District Livestock Officer positions, 5 Livestock Officer positions in service units and 18 officer-in-training positions at Research Stations. The head office complement of the Section comprises the Principal and Assistant Principal Livestock Officer (Sheep and Wool).

In-Service Training.—A sheep-handling and selection course was introduced this year. It provided opportunity for younger officers to develop these skills. The course was arranged in 2 sections; the Merinos section at Trangie and the British and Australasian breeds section at Cowra. Ten officers participated.

Attendances at other training courses were as follows: 7 officers at the Departmental Extension Methods School, 4 at the Departmental Farm Management Course; 6 at the Commonwealth Sheep and Wool Extension Officers' Refresher Course; and, also, 2 are enrolled in the 1-year Diploma of Rural Extension course (post-graduate/post-diplomate) at Hawkesbury College.

Annual Seminar.—The Annual Seminar for officers of the Section was held at Cowra, on the theme "Commercial Aspects of Prime Lamb Production". Officers of the Commonwealth Bureau of Agricultural Economics and the Bureau of Census and Statistics, the CSIRO, the University of Sydney, and the Victorian Department of Agriculture, as well as officers of the New South Wales Department presented material. Two officers of the CSIRO Division of Animal Genetics, Ryde, also atended.

Extension Service

Overall Trends.—Associated with the wheat industry situation and the falling returns from wool the demand for the economic approach in advice, on a whole-farm basis, has continued to increase. A good response to the programmed development of Farm Records Analysis Groups has been obvious.

Interest in measuring animal production and in up-grading the quality of flocks has notably developed.

The number of field demonstration units has been increased and greater use made of group extension. The following table shows the types and totals of demonstration units active in 1969–70.

Type of Demonstration Unit	Totals of Projects 1969-70
Improving reproduction	62
Improving carrying capacity and use of pastures	23
Use of scientific methods in sheep selection	18
Improved husbandry standards and techniques	42
Weaning weight service: number of properties	17
Fleece measurement service—	
Number of properties	112
Number of samples	5,517

Specific subject-areas wherein those demonstrations and investigations have been channelled are as follow:

"*Improved Reproduction*".—Fertility definitions; Drift lambing; Joining rates—1 and 3 per cent rams; Ram percentage in maidens; Lambing performance of maiden Merino ewes; Effect of bodyweight on commencement of mating and subsequent lambing comparison; Controlled lambing; Performance of maiden ewes; Effect of Selenium and Iodine in lambing performance.

"*Improved Carrying Capacity and Use of Pasture*".—Evaluation of perennial grasses under various stocking rates; Comparison of lucerne and sudax; Rotational grazing of lucerne; Grazing value of summer fodder crops; Utilization of love grass (*Eragrostis chloromelas*); Prime lamb production using fodder crops; Kikuyu grass grazing trial; Wether grazing trial; Galvanized burr grazing trial; Summer crops finishing trial; Increased stocking rates; Winter fodder crops in management; Cereal grazing in management.

"*Use of Scientific Methods in Sheep Selection*".—Lifetime performance of twin and single born lambs; Selection on production performance; Comparative performance of South Australian and Peppin Merino strains; Comparative performance of Peppin, Goolgumbla and Haddon Rig strains; Shoulder strip ranking; Comparative trials with Collinsville and Uardry and Uardry daughter strains; Comparative trials with Collinsville, Trangie and station bred rams; Age at first mating and lifetime performance; Merino strain trials.

"*Improved Husbandry Standards and Techniques*".—Time of shearing; Mules survey; Mulesing at marking *versus* 10 months of age; Economic evaluation of change from Corriedale to Merino; Economics of grazing systems in prime lamb production; Comparison of wool production as against breeding replacements; Tooth clipping trial; Growth rate and wool production of "Fonthill" cross hoggets; Mineral supplement trials; Jetting efficiency trials; Efficiency of various ear tag types; Testing of re-usable ear tags; Importance of snails in the life cycle in *Fasciola hepatica;* Surveys on management practices; Tolerance of blowfly to organic phosphates; Economic importance of 5 in 1 vaccination; Economic importance of testosterone implants; Joining of 9 months weaners; Residues of chlorinated hydrocarbons in sheep grazing rice stubble.

Statistics of Extension Methods.—The next table summarizes statistically the various extension-method activities of the Livestock Officers (Sheep and Wool) and provides a 2-year comparison.

Type of extension method	1968-69	1969-70	Percentage Increase or Decrease
Property visits	3,447	3,249	−5·7
Demonstrations	153	162	+4·5
Field days and lectures	302	364	+20·5
Radio, press and television contributions	791	751	−6·0
Surveys	8	6	—25·0

Competitions

Sixty-six entries were received in the "Country Life" Merino Ewe Competition; a 20 per cent increase on the previous year. Zone judgings were carried out by District Officers. The State judging was followed by 7, informal-group discussions; a departure from the traditional, lecture-type of day usually associated with the State judging.

Five Prime-Lamb Carcass Competitions were organized and judged by District Officers. Interestingly, these competitions were all judged by carcass measurement. Visual appraisal was eliminated. The judging was based on a New Zealand system developed at Massey University; with modifications to points-allocations for leg-length, to suit the slightly longer legs in Australian lamb. Each judging was followed by a field day.

Industry Sale—Use of Production Records

At the 1970 Sydney ram sales this year 2-tooth production records were included, in co-operation with the University of New South Wales, in a separate sale-catalogue prepared for those studs participating in the Department's and the University's fleece measurement services. This was a "milestone" in the acceptance and use of production records, by the industry, in breeding-programmes and livestock-transactions. For rams sold with production records, there was a much closer relationship between price and production-ranking than in the previous year.

Sheep Classers' Convention

The second Sheep Classers' Convention was held. The first convention, held in 1965, provided members of the profession with scientific, Merino-breeding principles and led to the formation of an association of professional sheep classers. The second, in 1969, of 2 days' duration, dealt with technical aspects of wool-quality and improvement. Among the participants were leading personnel from the CSIRO Division of Textile Research and representatives of a Japanese wool-buying firm.

Professional sheep-classers influence the breeding-strategies of Merino studs. Their request for the follow-up, 1969 convention reflected the profession's intention to be fully informed of developments in sheep and wool research. The convention promoted liaison between sheep classers and the Department's research and extension workers.

Colombo Plan Course

The first 3-months' course in sheep management, for fellows from Afro-Asian countries, was designed at the request of the Department of External Affairs; 19 fellows attended—from Ceylon, Ghana, India, Iran, Kenya, Korea, Nepal, Syria and Tanzania.

Sydney Sheep Show

Eighteen officers assisted. This year, additional officers were assigned to the Show to guide and advise the 20 Colombo Plan fellows who were in Australia for a Sheep Husbandry Course.

Departmental Sheep

About 29,000 sheep were run at Departmental Research Stations and Agricultural Colleges; most being used for research.

Sheep Industry Trends

The excellent season resulted in a serious blowfly situation and unprecedented interest in the mules operation. This interest so developed that some producers undertook mules-contracting additional to the accepted already-established contractors in the industry.

Wool prices were considerably down on the previous year but, in general, increased production because of the seasonal conditions helped to compensate. There was a noticeable penalty by buyers where clips contained vegetable fault and dust.

There was marked increase in number of finer-woolled Merino rams, leading towards production of finer clips. Further, the use of Merino rams has been adopted in Corriedale flocks to produce finer-quality wool and offset the low prices for crossbred types. In the crossbred field the Border Leicester has suffered reduced joinings, being replaced quite noticeably by Dorset Horn and Poll Dorset rams—to produce a finer crossbred-wool.

More lucerne than previously was sown and rotationally grazed in 1968-69, with signs of further acceleration of the practice in the ensuing year. Reports have indicated improved carrying-capacity and production-efficiency as a result.

Notwithstanding a sharp increase in cattle numbers and the firm cattle-market a number of areas have reported that, on a whole-property basis sheep are giving better return to capital than cattle. The cost-of-development of cattle projects is a factor.

Use of measured-production has further increased. The percentage of users in relation to the total rural holdings is not yet high, but their rate of increase from year to year is sound.

Lambing percentages were good. Reports of up to 70 per cent of ewes joining to the first cycle were made. Good seasonal conditions stimulated better conception and birth rates, but continued increase of the proportion of autumn-joined flocks also contributed.

Other trends are tabulated: land values fell and sales of properties were few; cattle numbers increased but not at the expense of sheep numbers; motor cycles and mini-mokes became far more prevalent as work vehicles; hay stacks were replenished where hay making is normal, but there was apparent reappraisal of the economics of hay-making—particularly in view of relatively low-cost availability of grains; water-stain and grass seed in wool were problems in a number of areas; prices encouraged the marketing of quality prime-lambs at the right stage, instead of retention for heavier weights and "possible" higher prices; publicity on "daggy" sheep was effective, and recent refusal by stock agents to accept many of the lambs submitted to saleyards forefronted the importance of clean sheep; there was noticeable rejection of harsher-handling wools, in flock selection; use of marking-harness on rams during mating increased, and effectively contributed to management in the present limited-returns situation; reports from some areas indicated shortage of shearers and rural labour, the most obvious cause being the opportunities for employment in secondary industry.

BEEF CATTLE, HORSES AND GOATS SECTION

Staff

Numbers, and District Distributions.—At 30th June, 1970, the Section comprised 24 Livestock Officers (Beef Cattle, etc.). Five had commenced duties during the preceding 12 months. Two District Livestock Officers were appointed, to vacant positions, and 2 others to new District positions. The Section now has 1 District Livestock Officer in each of 7 of the 9 Agricultural Regions, and 2 District Livestock Officers in each of the other 2 Regions.

In-Service Training, etc.—Four officers completed and another 4 began periods of training on properties in northern Australia. Three officers attended Departmental Farm Management courses and 6 attended Departmental Extension Methods courses.

A Section Conference was held at Orange in December, 1969. Each officer, as well as Livestock Research Officers and invited speakers, contributed to the educational programme.

The Australian Meat Board Technical Adviser Mr J. P. Wilson demonstrated the recently developed Australian Cattle Carcass Appraisal System to 21 officers; at Homebush and Grafton.

One Livestock Officer (Beef Cattle) was enrolled in the Diploma of Rural Extension course at Hawkesbury Agricultural College. Another attended the Australian Beef Cattle Review Conference in July, 1969. Another was awarded an R.A.S. Travel Scholarship for 1970.

Extension Services

Statistics of Methods.—1,160 individual farm-visits; 80 field days attended and/or serviced; 33 beef cattle schools and 33 other schools serviced; 77 meetings and conferences attended and/or serviced; 66 stock and carcass shows and 62 stock sales attended; numerous visits to research stations for liaison purposes; 140 radio releases, 84 press statements, and 9 television presentations contributed; 4 publications, and numerous contributions to farmer's notes and other local bulletins.

Demonstrations/Trials, etc.—Forty-three trials were conducted, in relation to: heifer management; crossbreeding; lot-feeding; crop-fattening; phosphorus deficiency; nutrition/fertility interactions; supplementary feeding; freeze-branding; lice control; hemi-castration, and pattern of liveweight-changes.

Three surveys were continued: 1 of agricultural practices within a Shire, 1 of beef cattle management-practices within a Region, and 1 of dystokia incidence within a Region. Twenty-one Beef Cattle Improvement Demonstrations (C.E.S.G. Project 505) were continued, 8 were begun and 1 was ended.

Beef Cattle Breeders' Competition.—110 teams entered, and were judged at District level by Livestock Officers. One was State judge for the 8 finalists. The judging occasions provided opportunities for group extension, stimulated interest in cattle reproductive-efficiency, and enhanced relationships with cattle-producers and potential cattle-producers.

Programme Planning, and General.—The difficulties involved in servicing large numbers of producers, in an industry spread over wide areas and subject to irregular seasonal fluctuations, yet an industry expanding at an abnormal rate, emphasized the advantages of an organized but flexible approach to extension activities. During the difficult transition to extension-programming, and work-plans, when guidelines are still being clarified and the skills of these procedures are still being developed, some variations in officers' approach and results were inevitable.

The objective of the Section was to plan and execute the optimum combination of activities without surrendering initiative and the capacity to adapt educational material and procedures to altered industry needs and seasonal factors. A trend toward more small-group functions, such as informal field days and formal and informal gatherings by invitation, was observed. Such functions appeared to provide greater feed-back of producer needs and problems.

The big percentage of activity-time spent in travelling, much of it outside normal office-hours, added to the stress of effective operations by field officers. Some of their suggestions, directed toward reducing stress and utilizing their time still more effectively included: "provision of portable recorders", "two-way radio", "improved report-format", "additional clerical and officer-in-training assistance", "additional beef cattle field-assistants", "cattle-weighing scales", "reduced geographic-area of responsibility", and "appointment of a beef industry research-liaison officer".

Some Notes on Departmental Stock

A Murray Grey stud was inaugurated at Wagga Agricultural College. Twenty-eight beef bulls sold from Departmental studs this year realized $14,800.

Arab horses from Wagga and Hawkesbury Agricultural Colleges were successfully exhibited at the Sydney Royal Show. The first reduction sale of Arab horses was held at Hawkesbury Agricultural College, on 23rd April, 1970. All lots offered sold readily, at good prices. A total of 23 horses were sold during the year, and realized $38,050.

Industry Trends

Notable features were the increase in cattle numbers and production, and exports, and the fall in calf-slaughterings—indicating less wastage of immature animals. Statistics for 1969 and 1970 in New South Wales were as follow:

	1969	1970
Cattle totals, mainly for meat production (preliminary estimates)	3,892,000	4,588,000
Slaughterings:		
Cattle totals	1,033,000	1,283,000
Calf totals	383,600	261,000
Production (carcass weight; tons)	217,011	272,733
Exports (shipped weight; tons)	31,168	50,389

The increased interest and apparent investment in beef production were due to: seasonal conditions capable of supporting larger numbers; diversion of interest and resources from other forms of primary production with seemingly less-profitable prospects; influx of cattle from drought-stricken Queensland; increased export opportunities.

Trends observed within the cattle industry this year included increased interest and activity in: sale on "the hook" and on "liveweight" bases; pasture improvement; time-of-breeding operations; crossbreeding and vealer production; artificial breeding; supplementary feeding: lot-feeding, and crop-fattening; and performance-recording.

PIG SECTION

Staff

Numbers, etc.—Establishment strength of the Pig Section was increased to 18 positions; a new position having been created in North Western Region. Two officers resigned, 2 were appointed, 1 returned from National Service; 1 position remained unfilled. The staff situation at 30th June, 1970, was: 1 Principal Livestock Officer, 6 Senior Livestock Officers, 10 Livestock Officers.

In-Service Training and Conference, etc.—The training of junior officers continued at the Department's Colleges and was extended to incorporate periods of 3 months in various Regions. Four officers benefited by this training. Junior officers also attended the School for Pig Raisers at Hawkesbury Agricultural College.

Officers also attended Farm Management and Extension Methods Schools, while 1 officer was selected to attend the Rural Extension Course at Hawkesbury Agricultural College.

All Livestock Officers (Pigs) and the Research Officers engaged in pig research attended the 1969 Annual Conference of Pig Production Officers, at head office.

Extension and Regulatory Services

Statistics of Activities.—The activities of Livestock Officers of the Pig Section in fulfilling extension and regulatory duties are summarized statistically in the following tables (with 4 years' for comparisons):

	1966–67	1967–68	1968–69	1969–70
Farm visits	1,461	1,844	1,734	1,875
Meetings attended	71	85	119	131
Pig sales attended	114	121	105	105
Field days attended	19	35	39	47
Bacon factories and abattoir visits	44	51	59	82
College and research visits	51	57	67	60
Shows attended	16	28	26	30
Lectures and demonstrations given	104	87	116	129
Swine Branding Act inspections	22	27	27	33
Stock Food and Medicine Act inspections	32	12	42	56
Publicity statements for the press	76	116	105	160
Radio and television contributions	83	126	139	201
Schools	NR	NR	7	9
Carcass Competitions	NR	NR	NR	15
C.E.S.G. Demonstrations	NR	4	4	5

NR—Not recorded.

In-person Enquiries, etc.—All officers also handled—through personal interviews and by letter and telephone—a stream of requests for advice on all phases of pig production. In 3 Regions, Livestock Officers (Pig) acted as Officer-in-Charge in the absence of the Regional Supervisors.

Demonstrations, etc.—Demonstrations (under the C.E.S.G.) of effect of protein-supplementation in a pig's diet were extended to 2 Regions. Demonstrations on replacing part of the meat meal supplement with fish meal were ended. The demonstrations this year involved replacing part of the meat meal-supplement with soya bean-meal, and the comparisons of meat meal, whale solubles, and fish meals as protein supplements. Results of these demonstrations have yet to be completed.

Programmed Extension Objectives.—All field officers applied extension programme-planning. Objectives included: improved accommodation for pigs; improved nutrition; improved management; use of pure-bred boars; control of internal and external parasites; machinery in the piggery; and revision of extension literature.

The overall intended-effect, to lift pig-production efficiency rather than increase production (already at a dangerous level) was assessed as successful. Work-plans based on the programmed objectives provided for more than previous attention to radio, television and the press as extension media, and the conduct of 1-day schools.

Annual School for Pig Raisers.—This was held at Hawkesbury Agricultural College, with attendance restricted to 40 as usual. Most parts of the State were represented. There were also 1-day schools for pig raisers, conducted at 9 centres; in 4 Regions.

Swine Compensation Act

Assistance was given in the preparation, examination and processing of claims for compensation for pigs ordered to be destroyed and carcasses condemned because of disease. The position of the Swine Compensation Fund as at 30th June, 1970, is reported in the *Appendix I* "Accounts of the Department".

Swine Branding Act

The Register.—Some 938 brands and 24 licences were issued. Revision of the Swine Brand Register progressed, and sufficient cancellations of unused brands became available for re-issue to new applicants. The revision also revealed a number of brands in use by other than the registered person. Considerable work was entailed in organizing the transfer of those brands to present users. In all—572 transfers of brand to new owner.

The Swine Brand Index.—Revision of the Swine Brand Index used by country officers progressed satisfactorily. Two revised sections printed were distributed and 3 more sections were sent to the Government Printer.

The Department's Pig Herds

Large White, Landrace, Berkshire and Tamworth herds were maintained at Hawkesbury Agricultural College, Wagga Agricultural College and the Grafton and Wollongbar Agricultural Research Stations. Suitable pigs were supplied from the Hawkesbury herd for medical research at 2 centres. New bloodlines were introduced to Hawkesbury and Grafton herds. The programme of culling aged and unsatisfactory brood stock continued. The Wollongbar herd was out-of-production during rebuilding of the piggery section at that Station.

Some 1,127 pigs were disposed of (approximate value of $27,575): 54 stud pigs sold; 642 market pigs sold; 301 killed for ration; 130 used for research.

Pig Industry Trends

The pig industry expanded further. Preliminary figures indicated that the New South Wales "brood herd" increased by about 4,000 sows, to take the total to over 100,000 sows in production—for the first time in history.

Pig production as indicated by slaughterings for the year, again exceeded a million—with an approximate increase of 25,000 slaughtered. The record total of sows in production pointed to a further increase in pigs available for slaughter in 1970-71. Pig meat production increased by about 6 per cent, compared to that of the previous year. There was still a high proportion of pigs killed at the lighter weights, for consumption as fresh pork. For bacon and ham production, the increase was about 8 per cent.

"Top" prices for pigs were satisfactory, but with the increasing total of pigs available the price range widened. Very low prices were offered for lower quality. It was not unusual for the price range to be as much as 10 cents per lb. At the lower levels, many producers were forced to sell at prices below cost of production. Buyers were able to be selective. These conditions prevailed mainly at auction sales. As a result, producers showed preference for selling "on consignment"—direct to an operator or abattoir. This system enabled the producer to have a set price per lb quoted, and he was free of marketing costs such as yard-dues and commission. Some operators introduced their own weight-and-grade system for pigs so received.

Consumption of pig meats remained at a satisfactory level. Retail prices showed little or no variation from those of the previous year. At these prices, pork was able to compete with the higher-priced red meats.

In the 1968-69 year the export of pig meats from Australia to Japan was developed. About 680 ton of pig meats was sent in that year. For the 6 months ending 31st December, 1969, the relevant figure increased to about 3,970 tons and represented about 90 per cent of the total pig meat exported from Australia. The value of this export trade to the New South Wales pig industry is pointed to by the fact that other States look to New South Wales to take their surplus pig meats; thus, export of pig meats from any State benefits the New South Wales industry.

POULTRY SECTION

Staff

General.—A new Assistant Principal Livestock Officer (Poultry Meat Production) position was created and an appointment made. Appointments were also made to the positions of Parramatta District Livestock Officer (Poultry), and Officer-in-Charge, Poultry Section, Hawkesbury Agricultural College. An officer underwent in-service training prior to District appointment.

Training of Officers.—Officers received intensive in-service training before being appointed to Districts. Two attended the Department's Extension Methods School. Two attended Farm Management schools.

A handbook was prepared, for officers, of poultry industry information and recommendations made by this Department.

Extension and Allied Services

A Farm-recording Service.—This was introduced to encourage producers to keep records for analysis by poultry officers. The records enable comparisons of efficiency and assist in budgeting. They also indicate fields wherein research may be necessary. Ten farms operated in this service. It will be expanded.

Artificial-light Objective.—Encouragement of poultry farmer use of artificial light was part of the extension programme. Some 50 per cent of the farms have inadequate lighting.

Egg Quality.—Much extension work was in relation to improvement of egg quality, and elimination of the causes of poor quality—such as faulty housing, handling and nutrition.

Feeding.—Although there has been a definite trend towards purchase of ready-mixed feeds, officers met an increase in requests for formulation of poultry rations. Ration-formulations were done in association with Seven Hills Poultry Research Station. Trials of skip-a-day feeding were started in the Tamworth District.

Brooding Methods.—Investigations into methods of brooding and the reasons for faulty brooding were done in conjunction with a commercial integrator. As a result, a successful application was made to the Chicken Meat Research Committee for funds to purchase equipment and instruments to continue the work as an official, Departmental project.

Oil-Spraying of Litter, for Broilers.—Some trials of oil-spraying of litter for broiler chickens were conducted, because of overseas investigations showing benefits. Overseas claims of increases in weight gains were not substantiated. Further trials may be made, though it appears also that the cost of the materials could be too high to be profitable.

Publications.—District Officers regularly supplied extension articles to head office and many in turn were processed to the "Poultry Farmer" for weekly inclusion as a regular Poultry Section feature. Four issues of the Department's quarterly *Poultry Notes* were produced and distributed to poultry farmers.

Annual Poultry Industry Field Day.—This was held on a new site; most successfully because of additional space. Some 1,200 people attended and 42 firms exhibited. The theme for the displays and the day was "Disease Control and Farm Hygiene". The Department's stand featured also a display from the Veterinary Research Station, Glenfield.

Statistical Summary of Activities.—The following is a summary of activities of the Section:

Farms and hatcheries visited	1,517
Field days and demonstrations	11
Visits to manufacturers	57
Meetings attended	77
Articles for rural and industrial press	52
Radio broadcasts	117
Lectures and symposia serviced	126
Courses organized	3
Visits to Government institutions	175

Random Sample Tests

The 17th Random Sample Layer Test and the 8th Pure Breeds' Test were concluded. The general management committee decided to continue the Pure Breeds' Tests, though some members felt there was now insufficient significance in the testing.

Poultry Technology Course

The Poultry Technology Course at Hawkesbury Agricultural College commenced in April with 8 students, 1 of whom is a Departmental trainee. There is further detail of this new Diploma course in the Hawkesbury Agricultural College section of this Report (see page 245 and 251).

Some lectures were provided by members of the Poultry Section. The Poultry Section was involved also in arranging practical work and visits, for students in the course.

Survey re Organo-Chlorine Egg Residues

Poultry Officers, as well as Veterinary Officers and Veterinary Inspectors, participated in investigations into excessive residues of hexachlorobenzene and DDT in eggs. There was a marked increase in total of farms where excessive residue-levels have been reported.

The Poultry Processing Act (1969)

The Act was passed in the previous year but the drawing up of the Regulations by the Parliamentary Draftsman had not been completed. All other States, where simultaneous legislation is to be introduced, are ready and waiting for introduction of the Act.

Poultry Industry Trends

Egg Industry.—Egg production was the highest recorded for any year, and a 10·22 per cent increase over that of the previous year. Returns to producers were down by 1 per cent per dozen; to 33·4 cents. Egg Marketing Board sales showed an increase of 2·8 per cent whilst producer agency sales were up 7·5 per cent.

An increase of 20 per cent in the total of chickens hatched has added to the fear of too much over-production next year.

There was marked increase in started-pullet production. An estimated 20 per cent of replacement-stock was being produced as started-pullets by the end of the year.

Mortality amongst rearing- and laying-stock significantly increased. Some of the major problems associated with egg production include Mareks disease, chronic respiratory disease, wet droppings and lack of adequate records.

Farm registration figures at May, 1970, indicate the continuing trend to fewer but larger farms. The total of farms with less than 5,000 birds decreased and the total with more than 5,000 increased. Overall, there was during the 12 months a reduction from 2,746 to 2,519 in total of registered farms.

Meat Industry.—There was more stability in the poultry-meat industry, through *planned*-expansion by integrators. Discussions by integrators with representatives of the Broiler Growers Association and the Poultry Section contributed. The take-away fried-chicken market has led to considerable increase in chicken sales.

The following table provides opportunity to compare, for the past 3 years, the totals of chickens, ducks and turkeys slaughtered:

Totals of Poultry Slaughtered*

(Bur. of Census & Statistics*)

Year	*Chickens*	*Ducks*	*Turkeys*
1967–68	36,556,000	483,000	334,000
1968–69	34,838,000	683,000	535,000
1969–70	38,848,000	988,000	524,000

Feedstuffs.—A decrease in price of wheat bran and pollard reduced the cost of ready-mixed poultry feeds in some cases by up to $15/ton. With the larger layer-farms, interest in home-mixing has increased. Further development of home-mixing is likely, as has been especially apparent in the Tamworth District.

APICULTURE SECTION

Staff Increase

The Apiculture Section staff was increased by a further appointment bringing the Section to 8 Livestock Officers.

The officer with headquarters at Tamworth commenced the post-diploma Course in Rural Extension at Hawkesbury Agricultural College and was relieved by another officer. It is proposed that the latter officer be appointed next year to a new District position on the north coast.

Extension and Allied Services

Schools and Field Days.—A successful, regional beekeepers' school was held at Tamworth, and also the usual Annual School in Apiculture at Hawkesbury Agricultural College.

At Bathurst the local branch of the Commercial Apiarists' Association of New South Wales, and the Department, sponsored a highly successful field day at Bathurst Agricultural Research Station for beekeepers. More than 600 attended; including beekeepers from all beekeeping areas of the State, and from Queensland, Victoria, South Australia, Tasmania, and New Zealand.

The Industry's Production

The State's honey production was slightly above average. Abnormally mild and wet conditions inland for most of the winter, and early spring, promoted advanced growth of pasture. The damp, mild spring conditions caused blossom-failure of many eucalypt species but stimulated ground flora, and good honey crops were had from some plants that normally only provide a stimulus.

The showery conditions gave rise to widespread swarming-troubles, probably the worst ever. Beekeepers' swarming-control procedures, normally successful, were inadequate. Beekeepers with limited labour lost numerous swarms, while their colonies were weakened.

In the northwest, white box yielded well and there were good crops from silver leaf ironbark, clover, and lucerne. In the central west and northwest, bimble box, normally of little value, yielded its best for some 30 years. In the central west the main crops were from ground flora, with some from ironbark and green mallee—while the yellow box yielded moderately.

In the southwest, river red gum did not come up to expectations but ground flora and yellow box yielded well. In the far west, napunyah, coolibah, and black box yielded heavily and beekeepers who migrated their hives to the Wanaaring-Hungerford areas had difficulty in harvesting the honey fast enough.

On the coast the season was probably the worst experienced, and no surplus honey was available until the flowering of broad-leaf tea tree in the northern parts.

In the spring the packers' demand for honey was good but, as supplies came to hand, packers' resistance to the ruling price caused slight weakening. Generally, the honey was excellent quality, so some beekeepers held moderate stocks for improved prices during the winter.

Bee Diseases

The total of hives infected with American brood disease in recent years has decreased, compared with the early 1960's.

There were several outbreaks, mainly in the central west, but incidence amounted to less than 0·05 per cent of hives. With 1 exception the infection was restricted to 1 or 2 hives. This situation reflects the excellent co-operation between beekeepers and Departmental officers, and beekeepers' desire to report the disease early—to get the benefit of Departmental help.

In the case of the largest outbreak this year, the beekeeper was inexperienced. He had confused the symptoms with a less serious disorder and inadvertently spread infection by interchange of hive material.

Nosema disease was rather widespread inland in the early spring, when damp conditions favoured developments of the protozoan; but the stimulative conditions provided by ground flora—with abundant good quality pollen—reduced the losses of field bees.

The Departmental Apiaries

Queen Bee Supplies.—A record total of queen bees (1,000) was produced at the Department's main apiary, at Hawkesbury Agricultural College, and made available to honey producers in New South Wales and throughout the Commonwealth.

The Department is the main source of bee breeding stock in the Commonwealth and the supply of 1,000 queen bees, mainly for breeding, has a significant role in increasing yields.

Artificially inseminated selected-stock were made available, besides the naturally-mated strains.

Co-operation with other Institutions

CSIRO Liaison.—The Department liaised with the CSIRO Division of Food Preservation in a research programme concerned with composition of Australian honeys and the influence of production and refining techniques on honey quality. Departmental officers supplied information in relation to the industry in general, the main areas and methods of production, and the relative significance of the main honey producing species; took CSIRO specialists to areas of production, to acquaint them with matters warranting investigation; and obtained or arranged a honey supply from numerous floral species.

Others.—The Department co-operated with the Australian Honey Board in making the mobile honey-extracting van available—for use in production of a special colour film on the honey industry, and for Australian Broadcasting Commission use in producing a segment for the "Delta" TV series. Officers also assisted the Department of Primary Industry with recommendations regarding honey-marketing matters, and in particular with proposed Codex Alimentarius standards.

Equipment

A specially designed, mobile honey-extracting van, with appropriate research facilities, was partly equipped and provided a useful service. The van was financed mainly by C.E.S.G. funds. Many requests for its details were received from Departmental officers in other States and other countries, and from beekeepers throughout the Commonwealth.

Imported Bees

Apiary officers at head office assisted specialized officers of the Biological and Chemical Research Institute, Rydalmere, with quarantine procedures concerning queen bees from countries where internal mites (*Acarapis woodi internus*) do not occur. In new cages and with fresh escort-bees the imported breeding-stock were forwarded to local queen bee raisers, after examinations and certificates proved satisfactory. Except for scientific purposes, and subject to special conditions and approval by the Commonwealth Department of Health, importation from countries with internal mites is prohibited.

Issue of Export Certificates

The total of certificates issued for bees and apiary products being exported, interstate and overseas, increased.

Amendments to legislation now require the issue of certificates for all honey and bees moving from New South Wales into the Australian Capital Territory and to all mainland States. Certificates are also required for export of bees to other countries, and of honey to certain countries. Much work was entailed in the certificates' issue and the preparatory inspections.

Pastures Protection Section

Staff

At 30th June, 1970, staff employed by Pastures Protection Boards comprised (with previous year's figures in parenthesis): 36 Veterinary Inspectors (33); 59 Secretaries (58); 65 Rangers (65); and 77 Rabbit Inspectors (81). Two of the 59 Secretary positions were occupied at this date in a combined "Secretary/Ranger" role, and this comment would automatically apply to 2 of the 65 Ranger positions.

In-service Training

One Pastures Protection Field Officer attended an Extension Methods School. Two schools of instruction on rabbit control and "1080" poisoning were conducted for Rabbit Inspectors employed by Pastures Protection Boards; 1 at Glen Innes and the other at Bombala. A Refresher Course for Rabbit Inspectors has been organized for August, 1970; the third for those Inspectors who have completed at least 12 months service with a Board after having attended a "1080" school.

Rabbit Control Symposium

A symposium on rabbit control was held for Directors of Pastures Protection Boards. Most Boards were represented. The general reaction of Directors indicated that an effect would be increased rabbit-control activities within their territories.

Plague Locust Control

Extensive egg laying which occurred late in the autumn of 1969 indicated a probable very heavy outbreak of plague locust in the 1969 spring. Expectations were realized. An area of about 3 million acres in the central western districts was heavily infested with the insects.

A variation in treatment-policy allowed spraying from aircraft to start earlier than previously. As a result the insects were prevented from migrating from the outbreak area. Although heavy egg-laying occurred, the advent of a parasitic wasp helped to prevent extensive hatchings. A further, extensive infestation had been anticipated but did not eventuate.

There is, in far greater detail, an account of Plague Locust and counter activities, in the Entomology Branch Section of this Report (see page 171).

Travelling Stock Reserves

Applications for portions of Travelling Stock Reserves are being dealt with expeditiously. General reviews of Travelling Stock Reserves in Pasture Protection Districts are being undertaken by Pastures Protection Field Officers, towards ensuring that adequate provision is made for the needs of travelling stock and that reserves set aside for such stock are warranted and properly maintained.

Considerable difficulty has been experienced in various areas, by the effect of the inland urban development on the space available for travelling stock. On 13th January, 1970 Cabinet decided that funds should be provided by the Government for acquisition of lands for relocation of Travelling Stock Reserves. Such relocation would be around country towns where expansion had reached the stage of both the movement of stock and the further expansion of the towns being hampered. Financial provision has been sought in the estimates of the Department of Lands for 1970–71 to permit the implementation.

Identification of Cattle by Tail-Tags (see page 101)

All applications for allotment of identification or issue of a licence have been processed, and the necessary documents issued. The total number of certificates and licences issued to 30th June, 1970, was 54,462 made up as follows: *Form* 19—occupier of land, 49,977; *Form* 20—non occupier of land, 1,373; *Form* 24—Licences, 3,112.

Pastures Protection Act (Amendment) 1970

The Pastures Protection Act (Amendment) 1970, was passed by Parliament and received Royal assent. It now remains for the various amendments to be proclaimed and made effective. It will be necessary to formulate regulations before many of the new provisions of the Act may be proclaimed.

Registration of large-stock brands and sheep brands and earmarks has been kept up to date. Information obtained in association with applications for identification under the tail-tagging scheme showed that a substantial proportion of users of large-stock brands are not the registered owners. Towards bringing the registration of large-stock brands up to date, a committee has been investigating means and has made recommendations.

DIVISION OF DAIRYING

General

STAFF

Administrative Professional Staff Changes

Mr K. A. Hyde was appointed to the position of Principal Dairy Officer (Research) vacated by Mr F. W. Marriner transferring to that of Chief Lecturer in Dairy Technology.

Development of Livestock Officer Positions

Two new Livestock Officer (Dairy Cattle) positions were created and filled; Coffs Harbour and Maitland. There are now five such District positions. The new positions should notably increase the respective District's extension work.

A Livestock Research Officer (Dairy Cattle Genetics) position (not yet filled) and a Livestock Research Officer (Dairy Cattle Nutrition) position have also been created. For the latter a former University trainee of the Department is in further research training in the Division of Animal Industry. The other position has yet to be filled.

New Zealand Study Tour by Officers

Messrs Smith, Auld, Heptonstall and Battese did a 4-week tour in New Zealand in August/September, 1969. One week was spent at the Milking Machines and Bovine Mastitis Conference at Hamilton, New Zealand. The itinerary arranged by the New Zealand Department provided close study of the dairy industry. Of specific interest: high production through high stocking rates; discussion groups as extension media; development of dairy/beef production; and the herd recording and artificial breeding developments. A comprehensive report is available.

Participation in Standards Association of Australia (S.A.A.) Committees

The Deputy Chief represented in the S.A.A. Butter Wraps Committee; the Principal Dairy Officer (Extension) in the Dairy Industry Committee and the Detergents and Sanitizers Committee; the Assistant Principal Dairy Officer (Research) in the Farm Bulk-milk Tanks Committee together with a Dairy Officer (Research), and the Milking Machine Components Committee; and the Principal Dairy Officer (Milk Products) in the Factory Pipes and Fittings Committee.

THE INDUSTRY

Seasonal Conditions

Weather was favourable in dairying districts until late in the 1970 autumn. Increased pasture and crop were conserved as hay and silage. Lack of rain since March, 1970, has adversely affected production. By the end of June, 1970, some areas north of Sydney were in drought.

Milk production for the year in all districts was higher than in 1968–69; about 25 per cent higher in far north and far south coast areas.

Trends

Farm Total Still Decreasing.—The total of registered dairy farms (at 31st July, 1970) had fallen by 765 to 9,061; an 8 per cent drop. Some 312 dairy farmers in Milk Board areas and 453 elsewhere ceased to operate. In 1 far north coast Shire the decline was 23 per cent.

The continuing cost/price squeeze has been the main cause. Urban development in the Milk Board areas has also had an effect. Amalgamation of smaller, uneconomic units has contributed. And many farms in the north have gone over to veal and beef production.

Also Fewer Cows.—The total of cows in milk and dry fell by 33,956, from 603,956 to 570,000, in the 12 months ended March, 1970.

A trend to larger herds continued; the average now about 63 cows. Herds in excess of 200 cows are common in most whole-milk areas.

But Increased Production.—Despite the fall in dairy cow population, and the dry weather, milk production increased by some 32,000,000 to a total of 310,000,000 gallons. The Bureau of Census and Statistics data indicate the milk production figures from 1966–67 to 1969–70 as follows:

1966–67	322,995,000 gallons
1967–68	310,056,000 gallons
1968–69	277,623,000 gallons (drought year)
1969–70	310,000,000 gallons

Bulk Milk and Tanker Collection.—Some 3,027 dairy farmers, about one-third, now have refrigerated bulk-milk vats and the benefits of tanker collection. In some areas the changeover has been delayed by farmers waiting to see what industry policy changes may occur through establishment of the Dairy Industry Authority.

NEW SOUTH WALES DAIRY INDUSTRY AUTHORITY

A major industry-change, constitution of the New South Wales Dairy Industry Authority (D.I.A.), takes effect from 1st July, 1970. The D.I.A. will be responsible for registration and inspection of all dairymen, milk vendors, and milk stores. All Dairy Officers in the field are to be inspectors under the D.I.A.

Dairy officers appealed to all dairymen not yet registered with the local authority under the Dairies Supervision Act to be so before 30th June, 1970, as failure to do so would make registration with the D.I.A. difficult. The Australian Dairy Produce Board appealed to all States to refuse further applications, in view of excess butter and cheese. All who were registered under the Dairies Supervision Act at 30th June, 1970, would be deemed registered with the D.I.A. until renewal of registration is due.

NORTH COAST DAIRY FEED-YEAR ASSISTANCE SCHEME

Launched on 1st October, 1966 for 5 years, the scheme is now in its fourth year. Progress is summarized in this tabulation:

	Year 1 (Oct. 1966 to Sept. 1967)	Year 2 (Oct. 1967 to Sept. 1968)	Year 3 (Oct. 1968 to Sept. 1969)	Year 4 (in part) (Oct. 1969 to July 1970)	Four years total
Eligible farmers	5,428	5,216	4,684	4,308	
Participating farmers	4,171 (74%)	3,641 (69%)	3,354 (71%)	888	..
Claims paid	4,946	3,623	3,233	..	..
Value of claims paid (to nearest dollar)	$1,018,960 (including, in Year 1 only, $5 per acre to establishment-cost; $371,945)	$650,317 ..	$597,960 ..	$44,652 ..	$2,311,889* ..
Area for which claims were paid	74,389 acres	61,881 acres	58,369 acres	3,897 acres	198,536 acres
Average value/claim (excluding the establishment-cost aid in Year 1)	$131	$180	$185	$186	$16
Average acreage/claim ..	15	17	18	16	16
Average payment/acre ..	$9	$11	$10	$11	$10

* Although the number of claims paid, and the acreage involved, for the month of June 1970 are not to hand yet, the value of claims paid is known to have been $30,356. Thus the overall total of $2,342,245 has been paid out since the Scheme commenced in October, 1966.

Adverse seasonal conditions have affected the current 12 months operations, ending at 30th September, 1970, and unless there are useful rains by early August farmers will be unable to take advantage of the Scheme for the coming season.

The Scheme over the near to 4 years has been a useful extension tool. It has given participating farmers better knowledge of correct fertilizer-usage, seeding rates, and forward planning to meet feed needs. One of the major effects has been the great increase in number of farmers visiting district offices to discuss a planned programme.

DEPARTMENTAL DEMONSTRATION DAIRY FARM, BEGA

The Department has acquired, at Bega, a dairy farm. This is to be run commercially, as a demonstration farm. Previously it was owned by the Department of Education and was run as a small dairy by Bega High School staff, to aid student instruction in agriculture.

The property comprises about 260 acres of undulating to steep granite country, in 3 main blocks. A difficult farm to operate, it offers a challenge in terms of economic dairy farming.

A contract farmer will work it. A special advisory committee comprising Departmental officers and 3 local farmers has been formed. The District Agronomist has drawn up a 4-year pasture-development programme.

Pasture management, including extensive use of electric fencing, will be observed closely. Provision will be made for conservation of surplus feed, and for grain storage, for supplementary feeding.

The herd will be recorded under the Herd Production Improvement Scheme, and artificial breeding will be practised. Dairy hygiene, milking-machine efficiency and shed management will be other features receiving special attention.

Organized field days, group visits and group discussions will be organized as the programme unfolds.

MASTITIS CONTROL PROGRAMME

The Mastitis Control Programme formulated by the New South Wales Mastitis Co-ordination Committee continued, with funds from the Commonwealth Extension Services Grant.

Number of Demonstrations.—The total of demonstrations had increased from 30 at the end of 1968–69 to 40 (but see later sentences). This, allowing even for drop-outs, should lead to worthwhile results. Five withdrawals did occur this year, due to sales of farms or to ill health. Thus the net total is 35 demonstrations at this time.

Present Stage of Programme.—Seventeen farms have completed 12 or more months of the 24 control-period months, and 2 have completed 17 months. All of the others have completed 7 or more months.

Results to Date.—There has been a marked drop in incidence of pathogens, and in the percentage of positive quarters as measured by the Rapid Mastitis Test (R.M.T.). In the 17 herds which have been in the control programme for 1 year or more, the percentage of R.M.T. positive quarters has decreased from 36 in the initial Base Period to 18; a 50 per cent reduction. In 5 of the 17 herds the decrease has been from 35 to 11; 69 per cent reduction in R.M.T. positive quarters in the first year.

Graphs for each herd, prepared for various purposes, show a progressive picture of results. Among the graphs are some that are specific to "the quarter history" of each cow in each herd. This is an aid to determination of future treatment and culling.

Costs.—Cost of the programme will be assessed in detail at the completion. So far, the overall costs have been: 1968–69—$6,684 (for 6 months; 30 demonstrations); 1969–70—$17,155 (12 months; 35 demonstrations).

General.—The programme has imposed an exacting, time-consuming work load on field officers—especially District Veterinary and District Dairy Officers. Considerable planning and organization by the respective District Dairy Officer has co-ordinated the timing of farm visits to suit the several of his own officers concerned and the visits by officers of other Divisions of the Department. The team-work and co-operation of all concerned have been excellent, and the programme has run smoothly throughout the year.

Evaluation.—The effect of the control programme on production, and economy of it, will be closely determined when all results are to hand at the end of 1971. The results achieved have to be technically satisfactory *and* economically sound to be accepted by the farmer who has a herd mastitis problem.

INCREASED BULK MILK-COLLECTION

Installation of refrigerated, farm milk-tanks continued to increase. Two more factories started bulk milk-collection this year, and others continued to expand the system. The total of bulk milk-tanks installed to 30th June, 1969 was 2,370. In 1969–70 the total increased to 3,030, since 660 more tanks were installed this year. Thirty-three percent of the dairy farms in New South Wales now have refrigerated farm-milk tanks.

Regulatory, Extension, and Educational Services

DAIRY INDUSTRY ACT MATTERS

Registration of Dairy Produce Stores

Twenty-two new stores were registered. Nine certificates of registration were cancelled. The net increase was thus 19, making a total of 224 registered stores. Ninety stores were inspected; 60 per cent more than in 1968–69.

Certificates in Testing

Twenty-nine candidates were examined in the use of the Milko Tester (Foss Electric) method of determining fat per cent in milk; 26 Certificates in Milk Testing were endorsed.

Dairy Science Schools

	Schools	*Candidates Examined*	*Certificates Issued*
Milk Grading	16	152	105
Milk Testing	6	51	43
Cream Testing		52	43
Cheesemaking	4	22	22
Milko Tester Endorsement	5	29	26 (certificate endorsed)
Cream Grading	5	47	26
Buttermaking	6	47	46

Dairy Technology students at Hawkesbury Agricultural College are included in those "Candidates Examined" and "Certificates Issued" figures.

DAIRY PRODUCTS QUALITY: GRADING, INSPECTIONS, SURVEYS, ETC.

Butter

Total butter production for the State was 64,359,874 lb and butter-oil 14,371,000 lb.

Grading Services.—The Dairy Products Grading Staff regularly examined butter (and cheese) manufactured by New South Wales factories and despatched to Sydney, Newcastle, Wollongong, Canberra, and Wagga Wagga for distribution and storage before sale on the local market. Samples from Canberra, Wagga Wagga, and Wollongong were sent to Sydney for grading. Grading Officers are now stationed at Newcastle and Lismore where all butter for sale or storage in these districts is graded.

Details of the gradings were supplied to distributing agents, factory managers and District Dairy Officers. This information is basic to the quality control and extension work of Divisional field officers.

Statistics from the butter grading were used also as the basis for compiling the "Order of Merit" of the New South Wales Department of Agriculture, and for the conduct of the continuous Grading Competition for the Royal Agricultural Society of New South Wales.

Substantial quantities of butter and cheese were imported from other States, mainly from Victoria, to supplement local production. At the request of agents the quality was check-graded before distribution.

Samples of butter representing 1,515,387 boxes (56 lb) were graded, and 5,748 cheese samples were also examined. Other products such as butter-oil, dried milk products, cottage cheese, yoghurt, and margarine were examined and reported upon from time to time as requested by manufacturers and distributors.

Biological and Chemical Surveys of Butter.—Butter samples were taken regularly, for biological examination by the Biological and Chemical Research Institute and for chemical examination by the Dairy Chemist at Hawkesbury Agricultural College. Separate, representative butter samples were taken this year to survey the copper content of New South Wales butter in association with the Dairy Chemist at Hawkesbury.

Results of all biological and chemical analyses were sent to District Dairy Officers and factory managers.

Special Quality Investigations.—Special investigations into causes of quality defects at various factories were continued. The Biological and Chemical Research Institute participated in several.

Butter-Plant Surveys.—Regular butter-plant biological surveys were made. Samples were forwarded to the Chief Biologist for analysis and report.

Retail Butter Surveys; Quality Control.—Surveys were regularly done in the Sydney metropolitan area and in country districts to determine butter quality at retailer-consumer level. Samples were subject to sensory grading and to biological and chemical analyses. Results of the surveys were made known to the Australian Dairy Produce Board, and any irregularities were brought to the notice of manufacturers and distributors concerned.

Experimental work continued in connection with surface deterioration of print butter and the use of various types of wrapping material. A photographic method of determining light-penetration of wrapping material was used for the first time and should prove of value to the industry.

Stores Inspections.—Dairy produce factories, margarine factories, and dairy produce stores in the Sydney metropolitan area were inspected. Remedial orders were issued where necessary.

Examinations for Certificates of Competency.—Examinations under the Dairy Industry Act were conducted in buttermaking and cream grading. Forty-six certificates were issued for buttermakers and 26 for cream graders.

Show Judging.—Grading Officers judged dairy produce at the Sydney Royal Show and the Newcastle, North Coast National, and other country Shows; also the various competitions associated with the Annual Conference of the New South Wales Division of the Australian Institute of Dairy Factory Managers and Secretaries.

Cheeses

Biological and Chemical Surveys.—These were done in association with the Department's Biological and Chemical Research Institute.

In the biological survey, 71 samples of cheese, taken from most New South Wales factories, were examined (an extra factory was included this year). For 1968–69 the percentage of satisfactory counts had been: for coliform, 77·1 per cent; for staphylococci, 67·7 per cent; for both, 55·2 per cent. For 1969–70 the respective percentage was 81·7, 61·0, and 56·3. The percentage of samples satisfactory for both counts was the best since 1955–56, but still left room to improve.

In the chemical survey, of the 51 samples submitted to the Dairy Chemist at Hawkesbury Agricultural College only some 25 per cent were found to be satisfactory, by Pure Food Standards. Some of the samples were sent for analysis because of problems in the factory, thus the results cannot be taken as completely representative of the output.

Some samples were unsatisfactory because of sediment; thought due to excess extraneous matter in the salt used. Currently a survey is being done to ascertain what percentage, if any, is carried over into the cheese.

Cheddar Quality.—Quality has vastly improved over the past 12 months, and particularly on the south coast. Much of the improvement reflects the activity of Dairy Officers in implementing Pure Food Regulations and Divisional policy in relation to grading standards and sediment in the raw milk supply, supervision of hygiene in manufacture, and improvement in equipment.

Other Than Cheddar.—Varieties manufactured are Ricotta, Romano, Mozzerella, Provolone, Fetta, Gouda, Edam, Pecarino, Blue Vein and, this year, 2 additionals—Camebert and Cheedam. Seven factories now manufacture these cheese types. Except for Cheedam (1,031,691 lb this year), production of the varieties has not expanded greatly and is suffering competition with imported cheeses—even though the local product is at least equal and in some cases superior in quality to the improved varieties.

Most imported cheese is handled by European migrants who distribute through delicatessen and other food shops owned by Europeans, and is sold mainly to migrants. Local manufacturers find this market difficult to break into.

Production of processed cheese has expanded more slowly than was anticipated. It totalled 3,912,039 lb in 1969–70, as against 3,375,000 in 1967–68; an approximate 16 per cent increase during the 2 years.

Production of cottage cheese and of cultured milk products are still expanding but the rates of expansion showed down a lot this year; possibly because of (a) a lesser quantity of surplus milk available and (b) buyer-resistance to a price rise—combined with a drop from 10 to 8 oz in yoghurt pack-size. Cottage Cheese manufacture totalled 1,433,000 lb, and yoghurt 1,291,133 gallons. A recent figure is not available for cultured or for sour creams.

Imported Cheeses: Inspections, and Biological Survey.—Some 1,238 tons (53 varieties, including cheddar) were imported through the Port of Sydney in the 12 months to 30th June, 1970; about 46 per cent less than in the previous 12 months.

Consignments of imported cheese were inspected at the respective importers' premises where possible, and samples were submitted for biological and chemical analysis. A total of 311 samples, representative of all imports, were submitted for analysis. The co-operation of all cheese importers in submitting cheese samples regularly is worthy of comment.

The results of the biological survey, (involving Division of Dairying, Division of Animal Industry and the Biological and Chemical Research Institute) will be discussed at a Conference of Chief Quarantine Officers (Animal) later in 1970, with recommendations concerning appropriate certification procedures for imported cheese.

Milk Powder and Condensed Milks

Milk-powder production increased compared with 1969, but for condensed milks the figures indicated a reduction. The explanation is that most condensed milks manufactured for use in milk powders were previously shown both as powder and condensed products; the figures for this year show condensed products manufactured and sold as such.

Investigations into biological defects of milk powders prohibited from export revealed that what had seemed low bacterial-counts in treated milk reflected wrong interpretation of results, by factory-laboratory personnel.

Export Milk Powders: Biological Investigation

Milk powders for export were bacteriologically investigated. The Commonwealth Department of Primary Industry had indicated that milk powder from factories with a high, total bacterial count would be prohibited from export.

The investigation proved in one case that contamination by thermoduric bacteria was being carried over from the raw milk supply. Dairy Officers in the District concerned then concentrated on reducing thermoduric bacteria in the milk supply. As a result the factory is now producing satisfactory powder for export. Also in another case the indications were that thermoduric bacteria caused the problem, and work to reduce them is proceeding.

Ice Cream and Frozen Milk Confections

The figures for ice cream appear to show less production than in the previous year; due probably to cessation of the interstate price-war, and to "soft serve" and "thick shakes" being shown separately (as they are not true ice creams). However, the overall total would represent a slight increase of production.

Some New Products

Cocoa Crumb and Cream Mixture appear in production figures for the first time this year.

SUMMARISING FIELD OFFICER ACTIVITIES

Statistics

The activities of the field officers of Division of Dairying in their extension and regulatory duties have been summarized statistically as follow:

Farm visits	15,127
Factory visits	3,677
Demonstrations and trials	54
Field days conducted	60
Meetings and discussion groups attended	394
Schools and Conferences attended	251
Mass Media—	
(a) Talks on radio and television (but including also talks at field days, etc.)	410
(b) Press articles	208
Tutorial classes conducted	174

Several of the Senior Dairy Officers in Districts are also "Officer-in-Charge at the respective centre. The associated duties reduce the time available for field activities—particularly so in Districts where the administrative burden of large, herd-recording establishments is in any case heavy.

Other activities of Dairy Officers besides those already tabulated included: office interviews; and correspondence, reports, and telephone contacts relating to Dairies Supervision Act, Dairy Industry Act, Pure Food Act, Factories and Shops Act, North Coast Feed-Year Scheme, Mastitis Control Programme, plus general extension matters.

Farmer Discussion Groups

Three new farm discussion groups were formed. Some of the previous 16 became inactive. Field officers found insufficient time for this type of extension because of increased demand on their services by the programmed Mastitis Control Demonstrations and other district commitments. As the total of Livestock Officers (Dairy Cattle) builds up, to provide for 1 in each Dairying District, greater promotion and support of discussion groups should be possible.

Plans are being made to conduct in Coffs Harbour District during August, 1971, 7 group meetings along similar lines to those followed in New Zealand. The Assistant Principal Dairy Officer (Herd Improvement), who recently visited New Zealand and observed the methods, will act as group leader.

Dairy Farm Improvement Competition

District Dairy Officers again acted as District Judges, and one as State Judge, for the "Country Life" Dairy Farm Improvement Competition; a useful extension medium in past years. Besides judging the competing farms in their Districts, the Dairy Officers have advised the competitors on whole-farm operation, development, and management.

The competition is jointly sponsored by "Country Life" Newspaper and the New South Wales Milk Board. This year there were only 16 entries, as against 37 last year. There are indications of need to revise or discontinue the competition.

Dairy Topics (Bi-monthly journal)

Dairy Topics, first published in 1956, continued to be available (free of charge) to all dairy farmers in New South Wales and to other people closely associated with the industry. Since the number of registered dairies had decreased to about 9,300, the mailing list was revised this year—and reduced by a big percentage. The number of copies printed has been reduced from 18,000 to about 10,000.

To ensure flow of material for publication, each Dairy Officer and Livestock Officer (dairy cattle) has been rostered to submit at least one major and one short article per year. The roster is proving successful.

The Herd Production Improvement Scheme

HERD RECORDING

The Change-over to Milk Meters

A highlight was the continued, planned change-over from milking-machine buckets to farm-milk meters for herd recording. Thirty-eight herd recording units now use milk meters, as against only 9 a year ago. Another 35 units will use them in the ensuing year and this means that over two thirds of all recording units will be so equipped. The change-over will be completed during 1971–72.

Herd Recording Staff

The establishment strength now provides for 129 positions (106 herd recorders, 12 relief recorders and 11 herd organizers). At the time of this Report, 120 positions are occupied (99 herd recorders, 11 relief recorders, and 10 herd organizers).

Fourteen more Herd Recorders qualified for the Certificate of Competency in Milk Testing, making a total of 83 for the last 4 years, and a total of 182 since March, 1965 when the Certificate was first issued. Fifty-six efficiency checks were done on Herd Recorders this year.

Official Recording (Registered Pure Bred Dairy Cattle Only)

These statistics are for the 12 months ended 30th June, 1969. The number of herds recorded was 315; an increase of 22 in the 12 months. Cows that completed lactations of 4 months and over totalled 9,897; an increase of 720 in the 12 months. Butterfat production average was 335 lb, while milk production average was 8,321 lb.

Group Herd Recording (Grade and Pure Bred Cattle)

Again, the statistics are for the 12 months ended 30th June, 1969. The total of cows recorded was 92,289. Some 77,631 completed lactations of 4 to 10 months, for a production average of 5,887 lb milk, 4·16 per cent test, and 244 lb butterfat; 4,639 cows completed short lactations, from 1 to 3 months, with an average of 1,473 lb milk, 3·93 per cent test, and 57 lb fat.

The "all in" average (for 82,270 cows completing lactations of from 1 to 10 months) was 5,639 lb milk, 4·15 per cent test, and 234 lb fat; an increase of 2 lb fat compared with the previous year.

Part-lactation cows totalled 10,019.

Total Herds Recorded and Cows per Herd

The total of herds recorded increased by 134, to 1,663; the total of recording units by 10 to 101. The number of cows per herd averaged 55, as against the previous year's 64. But this seeming reduction in herd size was most likely due to the number of new herds starting to record late in the recording year and, in consequence, only a portion of the herd being recorded.

District Averages

The top 3 Districts, by averages, were: Orange (993 cows)—8,812 lb milk, 3·7 per cent test, 326 lb fat; Deniliquin (10,405 cows)—6,496 lb milk, 4·38 per cent test, 284 lb fat; Maitland (10,983 cows)—7,156 lb milk, 3·95 per cent test, 283 lb fat.

Highest Individual Recording Units

The top 2 were both in Maitland Dairying District: Unit No. 10 (970 cows) 343 lb fat; and Unit No. 1 (1,080 cows) 337 lb fat.

Production by Length of Lactation

Cows milked for 10 months had a production average of 298 lb fat. Production increases with length of lactation. For example, cows milking for only 6 months had a production average of 137 lb fat.

Production of Age Groups

The 4 to 9 year old age group had the greatest number of cows (48,163) and the highest butterfat average (255 lb), while the 2 year old age group averaged 211 lb fat, the 3 year olds 233 lb fat, and the 10 years and over group 246 lb fat.

Butterfat Production Range

Twenty-eight per cent of the herds are in the range up to 199 lb fat; 45 per cent in the range 200 to 229 lb fat; 18 per cent in the range 300 to 399 lb; and 1 per cent in the range 400 to 499 lb fat.

Influence of Month of Calving and Length of Lactation

The average poundage of milk and of fat for cows calving in each month of the year, for each of the 13 dairying districts, showed a trend for the State similar to that in previous years: the majority of cows calved between June and September; best production from May to August calving; July calving providing the peak—with a production average of 239 lb fat. The longest lactations followed June and July calvings.

SOLIDS-NOT-FAT (S.N.F.) RECORDING

Analysis of data for 2,312 lactations for the 12 months ended 30th June, 1969 was completed. This brought to 14,391 the total of lactations analysed since the start of this Project (C.E.S.G. No. 504—Item 17) in April, 1961.

The S.N.F. percentages for A.I.S., Ayrshire, Friesians, Guernsey, and Jersey breeds had remained the same as for the previous year.

Effect of Age and Mastitis on S.N.F.

Analysis of data from the Departmental Stud Dairy Herds, based on 200 cows (A.I.S., Friesian Guernsey, and Jersey) with 586 lactations, has shown that the average annual decline in cows without clinical mastitis was 0·037 per cent for S.N.F., and in the cows suffering from clinical mastitis the average annual decline was 0·067 per cent S.N.F. Cows without mastitis showed a drop in S.N.F. due to age. Decline due to age was accentuated by mastitis.

Effect of Environmental Temperature on Milk S.N.F.

Analysis of data on 1,500 monthly production records, based on 47 Friesian cows at Hawkesbury Agricultural College (1966-69), has shown that the S.N.F. per cent was optimum at the low environmental temperature of 60°–70° F. A further rise in temperature to 85° F caused a slight decline in S.N.F., but the difference was not significant.

Lowest per cent S.N.F. was obtained at high environmental temperature of up to 98° F, and was significantly lower (1 per cent level) as compared to the S.N.F. per cent at low (60°–70° F) and medium (71°–85° F) temperature.

The results showed that optimum level of S.N.F. was obtained at low and medium temperatures, and a fall in S.N.F. per cent as the ambient temperature rose above 85° F.

STAGE OF PREGNANCY INFLUENCING LACTATION YIELD OF CATTLE

One hundred and eighty-one lactation records from 45 Friesian cows at Hawkesbury Agricultural College were analysed to determine the influence of pregnancy on production of milk and butterfat. The results indicate that pregnancy reduces milk yield after the fifth month. There is a tendency to increased rate of decline after 250 days of pregnancy.

RELATIVE-GENETIC-VALUE (R.G.V.) OF BULLS

To assess the proportion of bulls (with weight of 30 and over) with R.G.V. above 100, Herd Production Improvement Scheme data were tabulated and analysed for the bulls of all the five breeds. The results show that only 9 per cent (392 of 4,476) of the bulls had weight of 30 and over and that only half of these had R.G.V. value above 100.

SURVEY OF "FATE OF CALVES" IN NEW SOUTH WALES

Competed questionnaires from 145 farms, from 13 dairying districts in New South Wales, have been received. Analysis of the data is in progress. The results will supply information on potential meat production from dairy herds in New South Wales.

CALF MARKING SCHEME

Calves tattoo-identified in the year ended 30th June, 1969, totalled 14,616 and including 3,823 artificial-insemination calves. Since the start of the Scheme the total has reached 189,627; including 25,596 artificial insemination calves.

SIRE SURVEYS

Herd Recording data have been processed on the computer to provide two runs of the Sire Survey.

The first of these was the Official 1968-69 Survey. This Survey included data from all bulls who had daughters completing lactations in the 1968-69 recording year. The new information thus acquired was added to the surveys of bulls which had daughters recorded in this State since 1962; to give the updated survey of all bulls with daughters recorded.

The second Sire Sirvey run was the special interim one to provide the latest possible information for bulls standing at the Artificial Breeding Centres in this State before the start of the 1970 mating season.

Information from each of these runs has been made available to all extension officers of the Division of Dairying and to all Herd Recorders. Also, the information on bulls standing at Artificial Breeding Centres has been made available to the rural press. Any farmer seeking survey of individual bulls has also been given the information.

Herd recording data supplied to and received from Departments of Agriculture in other States have increased. The increased exchange of data has enabled early surveys to be obtained in respect of several young bulls used in more than one State. This movement of data between States will become even more important, particularly in the proving of bulls of the minor dairy breeds.

GOVERNMENT HERDS

The Departmental dairy herds continued at a high level of efficiency, and associated activities compared favourably with recent years.

Production

A highlight of the production figures for Departmental herds was the highest-ever production at Hawkesbury Agricultural College—where 55 Friesian cows averaged 14,165 lb milk and 513 lb butterfat; 1,005 lb milk and 31 lb of butterfat higher than in the previous year. Those performances mean that this is second from highest milk-producing and third from highest butterfat-producing herd in New South Wales.

Yanco Agricultural College Guernsey herd was the second from highest milk- and highest butterfat-producing Guernsey herd in the State (for herds milking more than 40 cows).

Also, the Yanco herd again won the William Newcombe Memorial Cup. This was the fourth successive year of winning.

The trophy is donated by the Guernsey Herd Society, for the herd with the highest producing group of 6 Guernsey cows. Production average for the 6 cows this year was 661 lb butterfat, and only 9 lb lower than the previous year's record production. The Department has now won this award 10 times since its inception in 1950.

The Poll Jersey herd at Grafton Agricultural Research Station and the Jersey herd at Wagga Agricultural College were third and fourth from highest milk-producing herd, of the respective breed, in New South Wales.

The A.I.S. herd at Grafton Agricultural Research Station was the fourth from highest milk- and fat-producing A.I.S. herd in the State.

Following is a tabulation of production averages (1968–69—the latest available) for Departmental herds:

	Average milk (lb)	Test Per cent	Average B.F. (lb)	Cows
H.A.C.: Friesian	14,165	3·6	513	55
Yanco: Guernsey	8,292	5·3	440	41
Wagga: Jersey	7,894	5·0	396	45
Grafton: A.I.S.	9,179	4·3	398	42
Grafton: Poll Jersey	7,896	4·9	383	47

Stock Sales

Demand for Departmental cattle continued, although fewer Jersey and Guernsey bulls were sold than in previous years; a decline attributed partly to the gradual departure of traditional buyers from the industry and partly to the increasing use of artificial insemination.

Eighty-four stud animals were sold; 65 bulls and 19 females, for a return of $13,000.

Stock Transfers

Twenty-four Friesians were transferred to the C. B. Alexander Agricultural College, Tocal. Fifteen Guernseys have been selected for transfer to Wollongbar Agricultural Research Station and 44 Jerseys for transfer to the Bega Demonstration Farm. Twenty-two head from Grafton Agricultural Research Station have been used at Wollongbar, in two separate research projects.

Some inter-Departmental transfers also were effected; one A.I.S. bull from Grafton Agricultural Research Station to Emu Plains Training Centre; one Friesian bull from Hawkesbury Agricultural College to Yanco Agricultural High School; and one Guernsey bull from Yanco Agricultural College to Morisset Hospital.

Stock Purchased

For the second successive year no stock was purchased for Departmental studs. Availability of semen from top quality bulls through artificial breeding is the explanation.

The first imported semen since relaxation of the importation ban has been ordered. It is from the English bull "Suttonhoo Idena Dividend", for use in the Friesian herd at Hawkesbury Agricultural College.

Departmental Bulls in Artificial-Breeding Centres

Eleven Department-owned bulls of various breeds are located at Artificial Breeding Centres in New South Wales. Two bulls were forwarded this year, and at present six more are under offer for use in artificial breeding.

Recent sire-survey information revealed that 2 Friesians, 1 Ayrshire and 1 Guernsey bred by the Department are in the 10 highest rated bulls at Artificial-Breeding Centres in New South Wales.

Competitive Exhibits, at Shows

Teams of Jersey, Friesian, Guernsey cattle, respectively from Wagga, Hawkesbury, and Yanco Agricultural Colleges, were exhibited at the Sydney Royal Show. The continued great achievements there by the Friesian exhibit have been detailed in the Hawkesbury Agricultural College section of this Report.

Teams were exhibited also at Leeton, Wagga, Grafton, Hawkesbury Shows, and the North Coast National Show at Lismore, with satisfaction.

Classification of Departmental Herds

The Guernsey, Jersey, and Friesian herd each took part in the respective Breed Society's Type Classification Programme. (The A.I.S. Society does not yet have a Classification Programme.)

Each of the three herds gained "Satisfactory" ratings for type. The Wagga Agricultural College and the Grafton Agricultural Research Station Jersey herd have several "Very Highly Commended" (V.H.C.) cows. The Hawkesbury Friesian herd has two cows and one bull classified "Excellent" and the Yanco Guernsey herd has one "Excellent" cow. "V.H.C." and "Excellent" is respectively the highest attainable rating for cows in the breed.

Herd at C. B. Alexander Agricultural College, Tocal

This college, acquired by the Department on 1st January, 1970, has a dairy herd of about 200—mainly grade Friesians and Guernseys. It has been run commercially and supplies a substantial quota of milk to the Dairy Industry Authority of N.S.W.

A number of registered Friesian cows have now been transferred from Hawkesbury Agricultural College to Tocal. And arrangements have been made to enter suitable animals of the herd in the Appendix of the Friesian Cattle Club.

Dairy Research Group Activities (Hawkesbury College)

GENERAL

New Principal Research Officer.—Mr K. A. Hyde has been appointed Principal Dairy Officer (Research). After a short study-tour of research establishments in the U.K. in February he took up the duties at Hawkesbury Agricultural College at the end of March, 1970.

Developments of Research Building.—Conversion of some unused basement space for detergent work has been completed. Further conversions for storage space, are intended. Also, plans for extension of the research building are being revised—to accommodate the anticipated continued expansion of activities. Meantime, the plans for the new research milking-unit, foreshadowed in last year's annual report, are being reviewed because of possible relocation of this section of the work at Wollongbar Agricultural Research Station.

Liaison with Standards Association of Australia (*S.A.A.*).—Participation in S.A.A. work continued. Officers of the Research Group worked on the S.A.A. Committee (DS/1), preparing standards for detergents and sanitizers for use in the dairying industry, and the Committee (DS/6) for dairy farm equipment.

Machine Milking School and Conference.—Continuing the general policy of holding an annual conference, alternating between Australia and New Zealand, a second Hygiene Conference was held. This was in New Zealand in August, 1969 and attended by the Dairy Research Officer (Mastitis). An approach has been made to the Australian Agricultural Council, for setting up a permanent Australian committee to undertake organization of the Australian conferences and provide liaison with the New Zealand committee.

Participation in the Mastitis Control Programme.—Some vital aspects of the monthly visits to the 35 farms in the Department's Mastitis Control Programme are a responsibility of the 6 Dairy Project Officers under the general supervision of the Assistant Principal Dairy Officer (Research).

DAIRY RESEARCH PROJECTS

Milk Powder Project

Work on this project has ended. The results were presented at the 1969 Australian Dairy Produce Board Seminar. A full report has been compiled and is being prepared for publication. A technical note has been submitted to the *Australian Journal of Dairy Technology*.

Infra Red Milk Analyser (*I.R.M.A.*) *Project*

The levels of precision and accuracy of fat, lactose, and protein analyses compared with standard methods were similar to those reported by the Canadian Department of Agriculture. However, this machine continues to give periods of unpredictable irregular readings. Thus there is doubt of its reliability, in its present form, for use on the intended large volume of routine analytical work.

Processed Cheese Project

A first draft of the *Manual on the Manufacture of Processed Cheese* has been compiled and is now being edited. An extension of the original draft is being contemplated, to cover processing machinery and packaging.

The following papers have been published: "Browning reaction in processed cheese"; "Use of calcium co-precipitate in processed cheese"; and "Evaluation of physical characteristics". A paper called "Instrument to measure firmness and elasticity in processed cheese" has been submitted for publication. One on "Subjective evaluation of processed cheese and the relationship between these physical characteristics" and one on "A study of the effect of the emulsifying salts on the physical characteristics of processed cheese" are in preparation.

A study of the characteristics of the liquid cheese in the kettle is proposed for the ensuing year; also work on processed-cheese spreads and processed-cheese foods.

The Dairy Chemist

The survey of chemical composition of cheese continued.

The Australian Dairy Produce Board project on relationship between chemical composition and the grading of export quality cheese was begun. Rapid analyses methods to cope with large numbers of samples were established.

A copper-contamination survey of New South Wales butter was completed and a paper submitted to the *Australian Journal of Dairy Technology.*

Technical Products Research

Nine trials on the continuous-fermentation plant resulted in two shutdowns due to mechanical faults, two due to bacterial infection, and five due to as yet undetermined causes. Likely factors have been studied intensively. There is evidence that the trouble is associated with a build-up of peroxide in the media. Further trial runs are proceeding, to establish the precise nature of the defect and to overcome it.

Some dairy factories producing cottage and fresh curd cheeses were visited and possible applications of continuous fermentation were noted.

Detergents Research

The circular-cleaning simulator has been tested and proved. Now the machine is being used to evaluate cleaning systems and for development work on new systems. The recirculation-cleaning simulator has been completed and is being tested.

The glass-slide evaluation techniques for general-purpose dairy detergents submitted to the S.A.A. in 1968-69 was given an interlaboratory trial. This trial revealed poor reproducibility, and an attempt to improve this was unsuccessful. The test, whilst useful for comparisons, is now considered unsatisfactory for standards work.

Sanitizer Research

A field trial of the efficiency of 12 skin sanitizers was completed and a paper is in preparation. A series of preliminary tests indicated that development of an *in vivo* laboratory method to evaluate skin sanitizers was impracticable with the existing facilities. After many experiments the *in vitro* laboratory tests for hard-surface sanitizers were discontinued, due to lack of reproducibility.

A programme of cow hygiene in relation to mastitis and milk quality is now being studied. For the first phase, the evaluation of post-milking teat-dips, the dairy herd at the University of Sydney farm, Camden, is being used.

Mastitis Research

Experiments on milking-machine performance have been postponed, pending decision on whether the proposed new milking-bail installation will be at Wollongbar. Meantime, attention has been given to the more general milking-routine management and hygiene—in association with the sanitizer research project.

Dairy Husbandry Work

A position of research officer to specialize on milking management has been forecast. If this position becomes a reality in the ensuing year, as expected, it will greatly strengthen the dairy husbandry team; though appointment of another, to cover milking-machine performance, is also needed.

Although the Department is no longer able, with existing establishment, to keep up with developments in the machine manufacturing industry, there has been heartening progress of co-operation between the three parties involved—the machine supplier, the farmer, and the relevant authority—towards improved standards of machine installation. The co-operative efforts are being conducted through the Standards Association of Australia, thus widening their influence. Similarly, the machine-cleaning system developed at the college now has widespread acceptance on farms in this State and probably most others.

In general, there is good liaison between the husbandry research group and the industry; through the various activities such as country visits and talks, attendances at conferences, work with S.A.A., the links provided by participation of the 6 Dairy Project Officers in the Mastitis Control Programme, and others.

BIOLOGICAL AND CHEMICAL RESEARCH INSTITUTE, RYDALMERE

(formerly "The Division of Science Services")

Biology Branch

GENERAL

Post-Graduate Training

Plant Pathologist Mr P. C. Fahy spent 3 weeks with Dr A. C. Hayward of the Department of Microbiology, University of Queensland, studying techniques in identification of bacterial plant pathogens. The work included a detailed examination of pseudomonads pathogenic to leguminous hosts, bacteriophage isolation, and preservation of bacterial cultures.

Plant Pathologist Mr H. D. R. Malcolm has completed requirements for the degree of Ph.D. at Macquarie University; his thesis: "Bud Failure in Stone Fruits (Peaches)".

Miss B. J. Ballantyne, Mr A. L. Bertus, Miss P. Broadbent, Mr J. K. McGechan, Mr R. D. Pares, Mr L. J. Penrose, and Mr D. Herridge are working on projects for the Master Degree; registered with the University of Sydney or Macquarie University.

Visitors

Dr K. F. Baker of the University of California, Berkeley, completed his visit concerned with research into antagonism between micro-organisms in soils.

Dr A. C. Goheen, of the University of California, Davis, a world authority on virus diseases of grapevines visited New South Wales during April and May. He visited all of the main vine growing areas, discussed the vine-virus position with Division of Horticulture and Biology Branch officers and made control-measure recommendations.

Dr W. G. Keyworth, Deputy Director, and Head of the Plant Pathology Department, National Vegetable Research Institute, Wellesbourne, Warwickshire, and Dr J. K. A. Bleasdale, Head of the Plant Physiology Department of that Institute, visited the Biology Branch.

Other overseas visitors included: Dr Mary Noble, Department of Agriculture and Fisheries for Scotland; Dr F. W. G. Jones, Rothamsted Agricultural Experimental Station, England; Dr F. Fisher, University of Florida, U.S.A.; Dr H. M. Munger, Cornell University, U.S.A.; Miss So, Department of Agriculture, Hong Kong; Dr B. Taylor, D.S.I.R., New Zealand; Dr B. Srydjon, Department of Agriculture, South Africa; Dr J. Corbin, Department of Botany, University of Auckland, New Zealand; Dr H. G. Atmadja, Department of Agriculture, Indonesia; and Mr T. Flint, Department of Agriculture, Auckland, New Zealand. A number of interstate pathologists also visited.

Conferences and Schools

Conference on Jarrah Dieback.—The Chief Biologist attended this Conference arranged in Perth by the Western Australian Forestry Department in November, 1969. The sessions provided a very full review of research programmes and results to date.

Plant Quarantine Conference, Canberra.—In November, 1969, the Chief Biologist attended in Canberra a review-type conference wherein modifications or strengthening of regulations were considered. Revisions of regulations about importation of some crops were foreshadowed.

Australian Vegetable Research Conference.—The Deputy Chief Biologist and 2 plant pathologists attended the Australian Vegetable Research Conference at Terrigal in November, 1969. Deputy Chief Mr Conroy presented a review paper and was discussion leader for the session on "The role of the plant pathologist in breeding for disease resistance".

A.N.Z.A.A.S. Conference.—The Chief Biologist and 4 plant pathologists attended the A.N.Z.A.A.S. Conference in Adelaide in August, 1969; the first A.N.Z.A.A.S. Conference to contain a section specific to plant pathology. The inaugural meeting of the Australian Plant Pathology Society was held in conjunction with the Conference.

Chief Biologist Dr Fraser was president of Section 18 of A.N.Z.A.A.S., the first occasion of a woman being president of any section of an A.N.Z.A.A.S. conference.

International Conference on Citrus Viruses.—Plant Pathologist Miss Patricia Broadbent attended the 5th Conference of the International Organization of Citrus Virologists (IOCV) in Japan in November, 1969. She then participated in a post-conference tour of Taiwan, Hong Kong, and The Philippines.

Miss Broadbent contributed a paper on the relationships of the citrus psorosis B complex. She read also a paper, for Chief Biologist Dr Fraser and Messrs Long and Cox of the Division of Horticulture, on the possible commercial value of dwarfing citrus by virus inoculation. Miss Broadbent was later invited to become a member of the IOCV committee on indexing procedures, diagnosis, and disease nomenclature.

International Grasslands Conference.—Bacteriologist Dr R. J. Roughley attended the 11th International Grasslands Conference, at Surfers Paradise, Queensland, in April, 1970, and presented a paper "The influence of root temperature on root-hair infection of *Trifolium subterraneum* L. by *Rhizobia trifolii* Dang.". Research Scientist Mr A. C. Robinson also attended and, with Mr J. Brockwell of the CSIRO, presented a paper "Observations on the natural distribution of *Rhizobium* spp. relative to physical features of the landscape".

Committee for Virus Tested Material.—The Chief Biologist attended in Canberra in June, 1970, the first meeting of the newly constituted committee for virus-tested plant material. This Committee agreed that a previous plan for a repository for virus-tested fruit tree material in northern Victoria was unsatisfactory and proposed that virus-free or virus-tested material now available be maintained in screenhouses associated with research institutes; also that each State would assume responsibility for such multiplication units as were needed. New South Wales will be responsible for repository material of citrus and some stone fruit.

U.F.W.A. Conference.—The Deputy Chief Biologist, at the Annual Conference of the fruit and vegetable section of the United Farmers' and Woolgrowers' Association in July, 1969, spoke on disease control matters.

Australian Society of Dairy Technology.—Special Bacteriologist Dr R. J. Richards attended the nith Annual Conference and Federal Council meeting of the Australian Society of Dairy Technology 52 Perth in July, 1970. Delegates, there from all States, considered reports from 17 technical subcommittees and recommended appropriate action.

Electron Microscopy School.—Plant Pathologist Mr L. J. Penrose attended a school on electron microscopy and associated techniques, conducted by members of the Electron Microscope Unit at the University of Sydney in May, 1970.

Symposium "Aspects of Plant Pathology".—Four members of the Biology Branch were invited to present papers to a symposium at this Institute in June, 1970, organized by New South Wales Branch of the Australian Society for Microbiology.

Interstate Quarantine.—Restrictions were continued on movement of stone fruit into New South Wales from areas of Victoria where *Sclerotinia laxa* occurs. Regulations about entry of nursery trees of possible hosts of *S. laxa* from Victorian nurseries were redrafted. The revision included requirements for removal of all dead wood and all wood which had borne flowers, and for dipping of all above-ground parts in benomyl.

Restrictions were continued on movement of lucerne hay into New South Wales from areas of where bacterial wilt occurs.

Biology Branch—Plant Pathology Section

CEREAL DISEASES

Wheat Diseases

Frost Damage.—Several frosts in the spring, after mild weather, caused widespread wheat losses in the central and northern areas. Some crops, heading when frosts occurred, were so heavily damaged that they were not harvested. Frost reduced by about 25 per cent this State's wheat yields.

Leaf Spot (Septoria tritici).—Heavy infections occurred in the southern and central wheat-growing areas. Unusually wet but mild weather in winter and early spring favoured a buildup of the fungus.

Stem Rust (Puccinia graminis tritici).—Susceptible varieties were infected heavily in the central districts. The wet, mild weather conditions of the winter and spring favoured the disease.

Black Point (*weather damage*).—Rain at harvest caused serious deterioration in grain quality, particularly in the north. Discoloration of the embryo-end of the grain (black point) was common, due to invasion by mould fungi such as *Helminthosporium* and *Alternaria* spp.

Oat Diseases

Smut (Ustilago avenae *and* U. hordei).—In trials at Rydalmere 14 varieties of oats and 4 collections of smut were used. Differing reactions of varieties to different collections of *U. hordei* indicated the presence of several races of this fungus.

The variety Milgee (Avon x Osage selection) was very susceptible to *U. avenae* but resistant to *U. hordei*. Milgee was grown widely in the State last year for seed increase, and most crops were smutted. Collections of smut were received from 33 crops of this variety, and all were *U. avenae*.

Barley Yellow Dwarf Virus.—This was widespread throughout the State in oats. Infected crops did not recover well from grazing and, at maturity, seed-set was poor because of blasting of florets.

Maize Diseases

Boil Smut (Ustilago maydis).—Viable boil smut teleutospores were found on several seed lines imported from the U.S.A. After seed treatment with the recommended rate of methyl mercury dicyandiamide (panogen), a volatile chemical regularly used to treat imported maize seed, 5 per cent of the spores still germinated. At a heavier rate of panogen found after trial, all smut spores were killed—without harming the seed.

DISEASES OF FODDER AND PASTURE PLANTS

Lucerne Diseases

Bacterial Wilt (Corynebacterium insidiosum).—Further suspect plants were examined for the presence of the organism. The bacterium was not found, and the disease is apparently not present in New South Wales.

Clover Diseases

Subterranean Clover Re-establishment Problem.—Two surveys of subterranean clover pastures on the southern tablelands and southwest slopes have been made to determine the distribution and define the symptoms of the disease.

The problem occurs in pastures established for several years and that have received regular topdressings of superphosphate. Stunting and poor growth of the subterranean clover in the winter are characteristic. The pastures recover and grow well in the spring. The small feeder roots of stunted plants are discoloured and rotting. *Pythium* spp. have been isolated consistently from these dead roots. The pathogenicity of *Pythium* spp. and other fungi isolated from diseased roots is being studied under controlled temperature conditions.

Subterranean clover plants showing the symptoms have been collected from Deniliquin, Albury, Tumut, Goulburn, Hartley, Condobolin, and Cootamundra, and from other sites within this area. Further surveys are planned to determine the complete distribution of the disease within the State.

Vetch Diseases

Post-emergence Damping Off (Pythium dissotocum).—Evaluations of several varieties of *Vicia* spp. for disease resistance were continued. *V. sativa* P.I. 1495 (contaminant in C.P.I. 23335) has shown high resistance, and *V. sativa* C.P.I. 26867 has shown moderate resistance. Both are resistant to rust (*Uromyces viciae-fabae*) and possess favourable agronomic characters. Selection for higher yielding types within P.I. 1495 is proceeding.

Grass Diseases

Kikuyu Yellows Disease (Cause undetermined).—The disease has continued to occur in epidemic proportions, particularly in the Clarence River Valley of the north coast. It has been introduced into healthy swards by transplanting infected sods. Transmission from affected to healthy plants has been demonstrated in glasshouse experiments. Dead plant material from diseased plants, or soil from affected areas, has not induced the disease in the glasshouse work.

The disease has been found to develop more rapidly and to a greater extent when the soil is warm (25° C) than when cold (15° C). This agrees with field observations on occurrence in the summer months.

All of 600 seed harvested from diseased plants produced healthy seedlings.

Empirical experiments for control of the disease have been started. One experiment aims to determine whether application of nitrate or ammonium forms of nitrogen fertilizer affect severity of th disease. Another aims to determine what method of cultivation will kill diseased grass, and whether a productive sward can be had from seedlings which establish in previously affected areas after the cultivation.

Ryegrass Leaf Spot (Cochliobolus sativus).—A severe leaf blight of ryegrass occurred at Taree in the late spring and summer. The disease was in a rank, spray-irrigated pasture.

In inoculation tests the fungus attacked three varieties of ryegrass under conditions of very high humidity, but not when the humidity was reduced below 85 per cent. Such conditions may exist in a rank pasture that is spray irrigated, but are unlikely to persist long enough for infection to occur in a pasture managed correctly.

Patch Disease of Bentgrass Turf (Unidentified Basidiomycete).—An undescribed, patch disease caused by a Basidiomycete was common on bent grass turf after treatment with the systemic fungicide benomyl ((1-(butylcarbamoyl) 2-benzimidazole carbamic acid, methyl ester)) for control of dollar spot (*Sclerotinia homoeocarpa*). The fungicide controlled dollar spot but predisposed the turf to the Basidiomycete patch disease.

This Basidiomycete proved tolerant to high concentrations of benomyl in culture, and its growth was stimulated at low concentrations. The fungus was disfiguring only. It did not attack the grass.

Stem Rust of Cocksfoot.—A trial to examine the effectiveness of an experimental fungicide, a co-ordination product of zinc ion and manganese ethylene bisdithiocarbamate plus nickel sulphate (dithane S-35), to control cocksfoot stem rust was set up.

The fungicide was applied at 10-day intervals in several treatments wherein the time of application of the first spray was varied. The object was to assess the effectiveness of dithane S-35 in reducing stem rust infection, and to determine when spraying must commence in order to minimize stem rust infection.

As no stem rust developed in control plots a significant result could not be obtained this year.

DISEASES OF OIL SEED CROP

Safflower Root Rot (Phytophthora drechsleri).—Safflower root rot was reported from many northern and southern areas, in dryland and irrigated crops. The wet spring favoured the disease. A survey of dryland crops in the Dubbo-Gilgandra district showed that 50 per cent of plants had been killed by root rot and, in some crops, losses reached 80 per cent.

Preliminary pathogenicity tests have been positive for *Phytophthora drechsleri* isolated from rotting tap roots of plants of the varieties Gila and VC-1.A. 35771 at Narrabri and Dubbo. Several *Pythium* spp. have been isolated also. Some of these can cause seedling damping-off. Studies are in progress on the etiology of the disease.

DISEASES OF VEGETABLE CROPS

Potato Diseases

Potato Seed Certification.—Division of Plant Industry recordings show that on the northern tablelands no crop was rejected from certification because of excessive content of virus or other diseases. A very low content of virus leaf roll was noted in some crops. Purpletop wilt (the tomato big bud virus) showed decline in incidence compared to previous seasons. Blackleg, particularly where cut seed had been planted, kept below certification tolerance.

In the Orange district, central tablelands, three crops totalling 16½ acres were withdrawn from certification because of excess virus leaf roll content. Also, one crop of 4 acres was withdrawn because of excess virus leaf roll and blackleg content. In the Crookwell, Taralga, and Cotta Walla sections of the central tablelands, 3 crops totalling 38½ acres were rejected because of excess blackleg content. Also, 1 crop of four acres was rejected because of an excess content of blackleg and impurities.

Common Scab (Streptomyces scabies).—Work in co-operation with the Division of Plant Industry to develop scab-resistant varieties continued. However, in this 1969-70 trial, at the Agricultural Research Station, Orange, insufficient scab developed on susceptible varieties to warrant an examination of other varieties or seedlings for scab reaction.

Rugose Mosaic (*Potato Virus X + Potato Virus Y*).—Field reaction of Departmental seedlings to Potato Virus Y (PVY) was further tested. The seedlings S2881 (now "Jala"), S2939, S2949, and S2952 reacted to field infection by PVY with a leaf drop streak symptom.

Bacterial Wilt (Pseudomonas solanacearum).—This was reported from the Dorrigo and Ebor-Hernani areas of the northern tablelands and in the Bellingen, Coff's Harbour, and Nambucca areas of the north coast. No infection was reported from Comboyne area.

Asparagus Disease

Asparagus Decline and Replant Problem, Gundagai.—Replanting of old asparagus ground at the Gundagai Asparagus Farm to the *Fusarium*-tolerant selections of the Mary Washington variety UC66 and UC72 is proceeding; a total of 130 acres in 1969-70.

The yield of marketable spears from the block of the *Fusarium*-tolerant selection planted in old asparagus ground in 1963 was again compared with that of comparable plantings of the susceptible 500W strain. Both were harvested in the later spring and early summer of 1968. The yields were: 500W strain, 2 791 lb/acre; *Fusarium*-tolerant selection, 2,873 lb/acre.

Progeny testing to produce a selection of the locally produced 500W strain tolerant to *Fusarium* diseases is continuing.

Tomato Diseases

Hormone-type Herbicide Injury.—Research continued on the problem of hormone-type herbicide injury, to tomatoes and some other crops, after dressing heavily with broiler litter. Crops in the Campbelltown, Sydney, and central coast areas have been affected. The symptoms, showing up in the warm period of the year, include growth distortion, narrow twisted leaves, and failure to set fruit. They are very similar to those caused by the herbicide, 2,4-D.

Bioassays have shown that 20 cubic yards of litter per acre of soil worked to a depth of 6 inches is the highest rate usable on tomatoes without producing symptoms.

Gas liquid chromotography analyses on the trimethylsilyl derivatives of methanol extracts from tomato plants, some grown in pasteurized soil and some in a broiler litter soil mixture, were done in an attempt to identify the injurious substance. Control plants contained some chlorophenoxy substances in the acid fraction. Affected plants showed much higher levels. Litter extracts had very high levels. The results were further verified by *Avena* straight growth bioassays.

Crucifer Diseases

Club Root (Plasmodiophora brassicae). Co-operative work with the Bathurst District Agronomist continued on the Macquarie River Flats. Club root is serious and widespread there.

The transplant-site soil drench (¾ pint fungicide suspension/transplant site), found to be the best way of applying fungicide in last season's trial, was used for a number of fungicides this season.

The fungicides captafol and dithane C90, excellent in last season's trial, and benomyl, are being compared with the previously recommended quintozene soil drench. Results still to be assessed.

Cabbage Black Ring Spot Virus (*CBRSV*).—CBRSV is the most important disease in the winter cabbage crops in the Hunter Valley, where the susceptible Ballhead Hybrid is the main variety. A field trial was done at Rydalmere to determine field reaction of 19 hybrid varieties. Six plants of each variety were inoculated with the virus. Yields of inoculated and uninoculated plants were compared 6 weeks after planting.

Yield of some varieties was severely reduced: Climax Hybrid, 55 per cent reduction; Ballhead Hybrid, 47 per cent; and Sanibel Hybrid, 41 per cent. In most varieties there were reductions of 10 to 25 per cent. Savoy King Hybrid recorded no yield reduction and showed no sign of infection. Resistance to infection by this virus claimed for Sanibel Hybrid in the U.S.A. was not found in this trial.

Sclerotinia Rot (Sclerotinia sclerotiorum).—Apothecial production by *S. sclerotiorum* is important as a source of spores. Research into the factors affecting production of apothecia from the sclerotia has been started.

Drying the sclerotia delayed production of apothecia initials by 1 to 2 weeks. Sclerotia subjected to a daily thermocycle of 15°–20° C produced initials in 3 weeks, while sclerotia held at constant temperatures (10°, 15°, and 20° C) did not produce initials till 5 weeks, and not until 7 weeks when held at a constant 5° C. After 8 weeks, sclerotia at the 15°–20° C thermocycle produced 6 times as many initials as those at a constant 20° C.

Field trials were done for control of *Sclerotinia*-rot in crops of seed cauliflowers. A soil application of 20lb quintozene/acre had no effect on apothecial production. Effect of the systemic benomyl on percentage infection of cauliflowers was determined. Benomyl was applied at 2 week intervals as a foliage spray at 4, 8, and 16 oz/100 gal. Though benomyl reduced the mean per cent infection at flowering from 80 per cent in the control to 44 per cent at the 16 oz rate, the differences were not significant at the 5 per cent level.

Diseases of Beans and Peas

Bean Seed Certification Scheme.—Division of Plant Industry recordings indicated that 4 crops totalling 37 acres were passed for certification and 4 crops totalling 8½ acres were passed for approval. One crop was rejected because of anthracnose (*Colletotrichum lindemuthianum*).

Summer Death of Beans.—This again caused severe losses. Resistant varieties, first introduced for testing by the Biology Branch, have been imported and been seed-increased. With greater use of resistant varieties losses have been reduced, and growth of the bean industry in New South Wales has been fostered.

Introduction of field testing of varieties to determine their reaction to summer death has continued. Of 164 lines grown at Yanco Agricultural College and Research Station, 31 were susceptible and 133 were tolerant or resistant. The lines included many curly-top resistant varieties and advanced breeding lines from the U.S.A., several European varieties, a wide range of dry bean varieties, and numerous new varieties introduced from overseas by seedmen and processors.

Several of the summer-death resistant lines, particularly two American lines (Apollo and X Ida 83) did well in several trials. Some of the trials were in association with Division of Plant Industry. Processors and seedmen maintained close interest.

Rust (Uromyces appendiculatis) *of French Bean.*—This can be troublesome, particularly in coastal areas. Some commercial varieties are very susceptible.

Of the lines in the summer-death trial at Yanco, 109 were exposed to a natural outbreak of rust in a replicated trial at Rydalmere in the 1970 autumn. Sixty-four showed good field resistance and could be grown in all areas of New South Wales with minimum risk of loss from rust. The 64 included Tendercrop, Gallatin 50, Apollo, Idelight, the X Ida 83 breeding lines, and all of the stringed varieties which have been commercially grown in this State.

Thirteen lines, including 8 European varieties and 5 U.S. breeding lines, had less field resistance; 30 were very susceptible and unsuitable for coastal areas or as late crops in inland areas where rust occurs. The 30 included the Great Northern, Pinto and Red Mexican types, most navy beans, many European varieties, and several Blue Lake types. Two varieties remained free of rust.

Virus Diseases of Peas.—Top yellows, an aphid-transmitted pea disease, is troublesome on the central tablelands in most seasons, and in other areas during some seasons. Results of field tests of pea varieties for resistance were in last year's report. The testing has continued. A replicated variety trial with 27 lines of peas was conducted in the 1969 spring, with Division of Plant Industry at the Agricultural Research Station, Orange.

Seven lines, including several Dark Skinned Perfection selections made by a New Zealand seedsman, showed a high level of resistance. Eighteen showed lower levels of resistance. Two, Yanco Choice and Yanco Packwell, were very susceptible.

Mosaic symptoms typical of infection by the aphid-borne pea mosaic virus occurred in 8 varieties. Victory Freezer and Coopers 75 showed more infection than other lines, many of which have been reported overseas to have resistance to this disease.

Mushroom Diseases

Virus Disease.—The virus disease of cultivated mushrooms was most widespread in the summer. Four different particles were associated with the disease. Fluctuations in relative numbers of the different particles could occur under certain environmental conditions. Some strains of cultivated mushroom grown in New South Wales could act as symptomless carriers of viruses. Virus-like particles were detected in a commonly occurring species of wild basidiomycete, *Laccaria amethystina.* This may be of significance in reaction of the cultivated mushroom *Agaricus bisporus* to sources of infection.

Spores of the cultivated mushroom spread virus diseases of this crop. Thus, spores harboured in the growing rooms and on equipment between crops must be killed. Commercial disinfectants in use in the mushroom industry were tested for their effect on viability of mushroom spores and mycelium.

Three disinfectants which gave a 100 per cent kill of mushroom spores were formalin (1 per cent v/v), hypochlorite (0·25 per cent v/v), and a combination iodine (2 per cent), phosphoric acid (16 per cent) (sani-mush) at 0·25 per cent v/v. Sodium pentachlorphenate (santobrite) gave complete kill of mycelium at a concentration of 0·1 per cent v/v.

Bacterial Disease.—Bacterial blotch disease was observed at several mushroom farms. It raises serious storage problems. Blotched mushrooms rapidly deteriorate in cold storage.

Bacteria were isolated from diseased samples. Preliminary identification, on morphological and biochemical characteristics, indicated the pathogen to be *Pseudomonas tolaasi.* Various sources are being checked for possible contamination.

CITRUS DISEASES

Phytophthora Root and Collar Rots

Factors in Poncirus trifoliata *Resistance to* Phytophthora citrophthora.—In two isolated instances, *Poncirus trifoliata* field susceptibility to *Phytophthora citrophthora* has been observed. In the first instance *Poncirus trifoliata* seedlings in the seedbed at Narara were attacked. In the second, collar rot lesions in 8-year-old Valencia and Washington Navel orange trees had extended into the trifoliata rootstock.

To study the effect of stock-scion combination and environmental factors on the resistance of *Poncirus trifoliata*, grafts of rough lemon and trifoliata bark were made into trifoliata and rough lemon stocks.

In only one of four experiments, conducted under identical conditions of temperature and humidity, was the infection of trifoliata bark induced and this was where trifoliata bark had been grafted into rough lemon stocks. The resistance or susceptibility of citrus rootstocks to *Phytophthora* gummosis can be modified by the scion but certain nutritional or physiological conditions in the tree also influence susceptibility.

The results indicate that the state of maturity of the growth flush, and possibly the carbohydrate levels, may alter resistance.

Virus Diseases of Citrus

Greening Disease.—Indexing of citrus trees for greening virus is continuing in the glasshouse at Rydalmere and in the field at Narara Horticultural Research Station. A graft-transmissible entity has been found. Its relationship to greening and stubborn diseases is being studied by electron microscope and by treatment of plants with tetracyclines.

Indexing of Departmental Mother Trees.—(a) Psorosis:—no tree was indexed last year. (b) Xyloporosis:—indexing is continuing in collaboration with Division of Horticulture. Last year trees of Accession Nos. 2053, 3742, 3743 and Narara tree No. 13 were showing xyloporosis symptoms.

Grapefruit Stem-pitting.—Observations have continued, in collaboration with Division of Horticulture.

Citrus Black Spot (*Guignardia citricarpa*)

New Recommendations.—A modified spray programme has been recommended for Valencia orchards in the Mangrove Mountain area to supplement programmes already in use. The new programme comprises a petal-fall spray of Bordeaux mixture 5-5-100 plus 2 fluid ounces of non-ionic surfactant. Two follow-up sprays of 2 lb mezineb/100 gals with 0·25 per cent white oil, at 8 and 15 weeks after the petal-fall spray, are recommended. The new recommendation has been developed especially for Valencia oranges in exposed situations to minimize surface rind blemish, without undue loss of internal quality.

Chemical control.—Experimental sprays were continued in a 31-year-old block of Valencia oranges at Mangrove Mountain. Programmes of promising fungicides were compared. Black spot incidence was only moderate, but yield in the experimental block was high and the quality good.

The fungicide containing copper zinc and manganese ethylene bisdithiocarbamate compared very favourably with mezineb. Internal quality and external appearance of fruit was good and black spot control was satisfactory. But melanose control was disappointing. Further testing in a combination programme with a petal-fall Bordeaux application will determine its suitability as an alternative to the newly recommended Bordeaux-mezineb schedule.

In an earlier screening trial (1967–68) captafol had shown outstanding promise for black spot control. The fruit had attractive appearance and satisfactory internal quality. At Mangrove Mountain last summer, however, very severe blemish to the rind of young fruits was caused when a scalicidal spray application of 2 per cent white oil was applied 2 weeks after an application of 0·2 per cent captafol; also considerable defoliation, starting about a week after the oil application. Black spot control was very poor on the fruit damaged by the interaction of these two sprays.

A programme of Bordeaux mixture 5–5–100 followed by 2 benomyl applications (2 oz active ingredient/100 gals) controlled black spot comparably with the recommended Bordeaux-mezineb programme. This promising material will be further tested.

In a screening trial at Narrabri two materials that showed promise in disease control and in producing fruit of attractive appearance were tetrachloroisophthalonitrile (daconil) and an experimental copper dithiocarbamate fungicide, dithane C90. Each has been included in a Mangrove Mountain field trial for 1970–71 season.

Melanose (*Diaporthe citri*)

Nine treatments for melanose control on Washington Navels were compared at Narara.

Programmes of wettable sulphur (4 lb/100 gals), lime sulphur (7 lb/100 gals), or captafol (3 lb/100 gals) as dormant sprays in early August, followed by Bordeaux mixture 6–6–100–¼ at petal-fall, failed to improve on the melanose control provided by a single Bordeaux mixture application at petal-fall.

Citrus Nutrition Research

The trial at the Horticultural Research Station, Narara was continued; collaborative with the Chemistry Branch and Division of Horticulture. The influence of various levels of nitrogen, potassium, calcium, and magnesium on mineral composition of the leaf and on fruit quality and yield are being examined.

DISEASES OF POME FRUIT

Apple Scab (Venturia inaequalis).—This was more troublesome than for several years past. Infections were heavy at Orange and on the northern tablelands. At Orange and at Batlow, Scab Spray Warning Services were again conducted in association with Division of Horticulture.

Apple Fruit Rot (Phlyctaena vagabunda).—This fungus causes losses of stored fruit in the tablelands districts each year. Occurrence of this fungus in apple branch pruning snags and cankers is now being studied.

Zinc Deficiency.—Spray was applied for the second year to correct severe zinc deficiency of apples at Neurea, near Wellington, in co-operation with the Chemistry Branch and Division of Horticulture. There is as yet little improvement in tree vigour. Samples were collected for zinc analyses.

Internal Bark Necrosis of Apples.—This disease causes bark pimpling and general loss of tree vigour. The effect of budwood source and soil treatments is being examined.

Virus Diseases of Apples.—Many of these latent viruses are responsible for decreased fruit yields. Identification and a study of characteristics of some are proceeding.

DISEASES OF STONE FRUIT

Brown Rot (*Sclerotinia fructicola*)

Evaluation of Fungicides.—Experiments with the systemic benomyl and other fungicides on peaches, apricots, and cherries confirmed the previous finding that benomyl is more effective than any other fungicide tested against brown rot. Suitable spraying schedules and application rates for benomyl were determined. Testing of new fungicides continued.

Epidemiology and Brown Rot Forecasting.—An investigation into the effect of weather on brown rot epidemics in peaches in the Murrumbidgee Irrigation Areas was completed. Epidemics occur only if there is prolonged rain when the fruits are ripe. Duration of surface wetness caused by the rain is important; losses occurring only if wetness duration exceeds 10 hours. Losses are most likely when wetness duration exceeds 15 hours. Several long, damp periods are more likely to result in an epidemic than is a single period.

This investigation has been discussed with the Bureau of Meteorology, and an agreement been reached to start a Brown Rot Forecasting Service in the Murrumbidgee Irrigation Areas in the 1970–71 season.

Root Rot of Peaches

The 1969 autumn and winter were exceptionally wet in the Murrumbidgee Irrigation Areas and many trees were expected to die from root rot in spring—as in the previous season after a wet autumn. Most losses were in orchards without tile drainage, but some were in orchards with tile drains where the autumn rains had prevented the laying down of adequate surface drainage furrows.

When *Phytophthora cinnamomi* was isolated from trees which had died in 1968, a survey was done in 1969 but the fungus was not isolated from any of the sampled orchards where peach trees had collapsed in 1969. This suggests *P. cinnamomi* is not widespread in the Murrumbidgee Irrigation Areas. It was found only from a few orchards in 1968.

The investigation revealed *Phytophthora cryptogea* in a number of orchard soils; also several species of *Pythium*. The role of these fungi in the root rot disease is at present not known.

Tile drainage effectiveness in preventing tree death raises the possibility that anoxia may be an important factor.

Peach Rosette and Decline in the M.I.A.

Work to determine the viruses involved continued. Samples from 400 sources were inoculated onto cucumber. During the earlier part of the summer, Prunus Necrotic Ringspot Virus (PNRV) was isolated from the majority of sources. However, PNRV became harder to isolate as the season progressed. The isolates could not be maintained in cucumber. This was due to variable temperatures and PNRV's sensitivity to temperature changes.

Attempts to transmit Prune Dwarf Virus were made difficult by a combination of technical deficiencies and unsuitable temperature.

Work to identify one of the viruses found associated with this condition has been started. The virus (greasy sunken mottle) causes dark sunken lesions in peach seedlings. Its role in the peach decline syndrome is not yet known. The initial work aims to compare this virus with the apple chlorotic leafspot virus.

A trial to assess the effects of virus infection on peach tree productivity is being arranged.

Apricot Decline (Suspected Virus)

Indexing and examination of affected trees are continuing. The locations of affected trees on several farms in the East Kurrajong area have been mapped, to study the pattern and natural spread of the condition. The decline has not yet been transmitted by virological methods.

DISEASES OF GRAPEVINES

Downy Mildew (Plasmopara viticola).—The exceptionally wet coastal and tableland spring led to early and severe downy mildew. The disease was recorded in the Upper Hunter in mid-October, and by late October in the Lower Hunter and Sydney districts. Extended rainy periods in November made control very difficult, and bunch infection and subsequent fruit losses occurred. However, overall losses were very slight.

The third season of spraying in a trial at Chipping Norton again proved the superiority of Bordeaux mixture, dithianon and captafol for downy mildew control. Quite inadequate was metiram and there was considerable defoliation in late November in plots sprayed with it. Persistence of dichlofluanid had not been good in previous trials but this season it controlled downy mildew at least as well as did zineb.

Dead Arm (Phomopsis viticola).—Light to moderate infections were widespread in the Murrumbidgee Irrigation Areas this season. This was mainly due to difficulty in applying dormant sprays, because of surface water in many vineyards.

In a spray trial, sodium arsenite applied less than two months before bud burst gave the best control. Spraying 3 months before bud burst gave poorer control. Although fungicides applied at bud burst have not shown great promise for control of this disease, captafol 3 lb/100 gals gave good control.

Virus Diseases.—A visit by the world-recognized authority Dr A. C. Goheen of California has clarified the grapevine virus position in New South Wales.

Fanleaf virus is almost non-existent in the main grape growing regions, but is present in some vines in County of Cumberland and Corowa districts.

Leafroll virus is widespread, particularly in Sultana, Zante Currant, Cabernet Sauvignon, Grenache, Black Muscat, Waltham Cross and Ouilliade. Black Shiraz and Semillon appear to be relatively virus-free, particularly in the Hunter Valley. Indexing for leaf roll has shown that this virus is in some clones of Gordo Blanco and Black Muscat.

DISEASES OF TROPICAL FRUITS

Banana Diseases

Leaf Spot and Speckle (Mycosphaerella spp.).—The infection season last summer led to the most severe outbreaks of these diseases for several years. "Baldy" bunches were in some unsprayed plantations as early as February, and were commonly found in June. Growers have been obliged to cut these bunches before maturity. Thus considerable quantities of thin fruit came to market.

Growers who had applied fungicidal sprays during the infection season avoided serious losses, even where only three applications. Growers who started their spray programmes late in the season (February or later) experienced unsatisfactory control.

Aerial spraying has been extensively adopted by banana growers. More than 3,000 acres received at least one spray application from fixed wing aircraft, and 500 or more acres were sprayed from a helicopter. Growers in Coffs Harbour area preferred a fungical mixture of mineral oil, maneb, and water at 2 gals/acre. Growers in other areas used this mixture, or mineral oil alone at 2 gals/acre, or a mixture of mineral oil and one of the protective fungicides—commonly zineb, maneb, or copper oxychloride.

Aerial spraying gave excellent control of leaf spot (*M. musicola*) because of the action of the mineral oil; particularly where 6 applications were made between December and April. Leaf speckle (*M. musae*) control was very poor with aerial spraying, because of poor underleaf coverage. Ground-based methods are essential for leaf speckle control, using the protectant fungicides at present available.

In experiments at Alstonville Tropical Fruit Research Station to determine whether the systemic benomyl would control leaf speckle when applied only on the upper surface of the leaf, benomyl provided some control when applied to the upper surface. But it was not as good as zineb applied to the undersurface of other leaves.

Market Diseases (Nigrospora sphaerica, Colletotrichum musae).—An experiment on 11 growers' properties evaluated the dipping of fruit in a suspension of thiabendazole, at 200 p.p.m., to control market diseases. Disease assessment on fruit after ripening was compared with that for fruit ripened under similar conditions but which had not been fungicidally dipped.

Thiabendazole controlled squirter disease on fruit from all growers but there were blackend symptoms on most fruit—particularly if the stem ends had been bruised. Only 1 fruit in 1,100 examined developed squirter symptoms after dipping, whereas 39 fruit of 1,100 undipped fruit did.

Passionfruit Diseases

Fusarium Wilt, Breeding Programme for Resistance.—This joint Biology Branch/Division of Horticulture project continued at the Horticultural Research Station, Narara. The aim has been to breed and select a plant of desirable type, resistant to *Fusarium oxysporum* f. *passiflorae*; based on hybridization between *Passiflora edulis* and *P. edulis* f. *flavicarpa.*

Of 360 self-pollinated vines planted out at Narara in December, 1968, 300 remain after culling. Vines are remarkably uniform in appearance, vigour and fruitfulness. Cuttings have been made from these plants to test for resistance to *Fusarium*-wilt at Narara next summer.

Brown Spot of Passion Vine.—The spraying experiment at Somersby section of the Horticultural Research Station, Narara, has been continued. The following percentage incidence of brown spot on fruit was recorded for the respective fungicide: mezineb, 6.4 per cent; captafol, 9.4 per cent; ziram, 10·6 per cent; thiram, 12·0 per cent; benomyl, 16·8 per cent; copper oxychloride, 22·7 per cent; and the non-sprayed treatment, 28·0 per cent.

In a non-replicated trial, mancozeb and an experimental fungicide containing copper zinc and manganese ethylene bisdithiocarbamate gave good control of brown spot, while thiabendazole and captan were disappointing.

DISEASES OF ORNAMENTALS

Azalea Petal Blight.—This was severe during the year. Testing of fungicides for its control continued. The systemic benomyl gave excellent control, showing both protectant and eradicant effect when used repeatedly for 7 weeks in the spring flowering period. Work on timing and concentration of sprays is in hand.

Dieback of Camellia.—Dieback caused by *Glomerella cingulata* (*Colletotrichum gloeosporioides*) causes serious losses in several cultivars of camellia and often leads to death of the plant. Commonly available fungicides have not given satisfactory control. The systemics benomyl and griseofulvin used as soil drenches show some promise but not complete control. Testing of fungicides is continuing.

Root Rot (Phytophthora cinnamomi).—The disease continued to cause severe losses of ornamentals. Current interest in and more widespread cultivation of Australian native shrubs has led to an increase of this disease in these plants. *P. cinnamomi* can be controlled in nurseries by stringent hygienic practices, but control is extremely difficult in open ground.

Chrysanthemum Leaf Nematode.—It was common during the autumn. Parathion or fenthion sprays usually give good control. Most of the damage observed was due to failure to spray.

Powdery Mildews.—These were reported on many ornamental plants during spring, summer, and early autumn. The mildews were generally not severe.

Rose Wilt (Verticillium dahliae).—The fungus is soil-borne. It causes a wilt of rose that rarely results in serious losses. In the past season in a metropolitan nursery it was consistently associated with a stem dieback condition although the roots and lower stems of affected plants seemed healthy.

Aerated Steam Treatment of Seed.—Studies on the effects of aerated-steam on seed and seed-borne diseases are continuing. This year, seed from 37 cultivars of lettuce were treated. For seed treated at 51·7° C for 30 minutes the percentage reduction in germination varied from 0 to 90 per cent. *Septoria lactucae* was eradicated from the lettuce seed by 20 minutes at 54·4° C, with no loss in germination.

PLANT PHYSIOLOGY STUDIES

Hormones' Effects

Various physiological effects detrimental to plant growth have been observed, mainly in vegetable crops. In some cases the hormones responsible have found their way directly into the soil whilst others have been produced by organisms *in situ.* Plant hormones are being examined in several different crops as indicators of onset of disease.

Some examples are: determination of the active hormone in broiler litter; production of gibberellin by *Fusarium* in lettuce soils at Wagga; residue of weedicides in vegetable soils at Mittagong; growth substances associated with split-corm in banana; changes in growth substances with onset of bud failure of stone fruits; and changes in growth substances associated with zinc deficiency in maize.

BIOLOGICAL CONTROL OF ROOT PATHOGENIC FUNGI

Naturally Occurring Biological Control of Root Pathogens

Some soils selected because of field inhibition of a pathogen have inhibited the mycelial growth of the fungus when it has been introduced into tubes of soil steam-treated at 140° F (60° C) for 30 minutes. No soils have inhibited growth of *Rhizoctonia solani*, but *Phytophthora* and *Pythium* spp. mycelial growth has not occurred through certain soils.

An avocado soil with field inhibition to *Phytophthora cinnamomi* has been studied. *Jacaranda acutifolia* test seedlings for *P. cinnamomi* grew well in soil to which *P. cinnamomi* had been added, when the soil had been previously aerated with steam-air at 140° F/30 minutes. But not in soil treated at 312° F (100° C)/30 minutes. At 212° F nearly all organisms were killed while at 140° F many organisms remained, including *Bacillus* and *Streptomyces* spp. In uninoculated soil, in the three treatments, jacaranda seedlings grew well. These experiments indicated that the organisms controlling *Phytophthora* were killed at 212° F but not at 140° F.

Isolation of Antagonistic Organisms to Root Pathogenic Fungi

Soils high in organic matter (e.g., volcanic avocado soils, Krasnozen forest soils, pine forest soils) have yielded large numbers and diversified species of *Bacillus* and actinomycetes. Marginal wheat soils from South Australia and sandy citrus and peach soils have been low in such organisms.

All soils tested yielded bacteria and actinomycetes inhibitory to fungal growth on agar, but some isolates stimulated sclerotium formation in *Sclerotium rolfsii* and others initiated rhizomorph formation in *Armillariella.* Actinomycetes were more inhibitory to Phycomycetes, in particular *Phytophthora* spp. than to the other fungi tested. Few *Pseudomonas* spp. were inhibitory to the fungal pathogens on agar.

Substances Responsible for Antibiosis

The inhibitory substance(s) produced by the bacteria and actinomycetes diffuse readily through agar. The antagonistic *Bacillus* isolates fall into two groups on the basis of the ability of their antifungal substances to pass through a dialysing membrane of average pore radius of 24°A.

With few exceptions the *Bacillus* or *Pseudomonas* spp. which have inhibited *Pythium* on agar have produced low molecular weight substances. Growth of the mycelium was inhibited; the hyphae burst just behind the apex, extruding cytoplasm. To date all bacteria producing low molecular weight antifungal substances have failed to control the fungus in soil.

Effect of Bacillus and Pseudomonas spp. on Rhizoctonia and Pythium Root Rots

In soil tests the antagonist, which has been concentrated by centrifuging down then washing a 1-day shake culture, is thoroughly mixed into steam sterilized (212° F/30 minutes) U.C. mix. One week later the soil is placed in punnets or flats, then sown to a susceptible crop and inoculated in one corner with the pathogen. Efficiency of the antagonist is measured by extent of growth of the pathogen.

In an initial experiment, 8 potential antagonists and control punnets with and without *Rhizoctonia solani* were sown to *Capsicum annum.* One isolate of *Bacillus subtilis* was an effective antagonist of *Rhizoctonia solani* but also increased plant growth in the absence of *Rhizoctonia.* This growth stimulation may have resulted from production of indoleacetic acid or gibberellic acid, stimulation of plant metabolism, or destruction of soil toxins, rather than from the control of root pathogens.

In later experiments it has been found that the effectiveness of an antagonist to *Rhizoctonia* varies as the *Rhizoctonia* strain. Most effective control was had against a slower-growing very pathogenic strain of *Rhizoctonia* obtained from wheat. This control may be due to the slow growth rate of the *Rhizoctonia* or to antibiotic specificity.

Five of 20 *Bacillus*, *Streptomyces*, and *Pseudomonas* antagonists effective on agar, have controlled *Rhizoctonia* in soil. Only 1 of 13 isolated antagonistic to *Pythium* on agar have controlled the disease in soil.

NEW RECORDS OF PLANT DISEASES

Over 50 new records of plant diseases were made in New South Wales. Among these were a root rot of safflower caused by *Phytopthora drechsleri* Tucker and a leaf spot of rye caused by *Pyrenophora semeniperda* (Brittlebank and Adam) Shoemaker.

Several new records of grass leaf spots were made during the 1969 spring.

On vegetable crops, several species of *Fusarium* were found associated with potato tuber rots. They were identified at the Commonwealth Mycological Institute, and some represent first records on potato in New South Wales.

On ornamental plants were several new records of root rots caused by *Phythophthora* spp. Also a fly speck disease of the ornamental hibiscus caused by *Microthyriella hibisci* Stev. Several other diseases of native and ornamental plants and weeds were recorded.

CHECK LIST OF PLANT DISEASES IN NEW SOUTH WALES

The manuscript on diseases of cereals and grasses and field and fodder crops is still in preparation.

The main check list work this year has concerned the taxonomy of certain cereal and grass parasites. These investigations have been expanded because several parasites in this group are common in New South Wales and knowledge of their identity is essential to understand their field behaviour. It has been necessary to try to clarify generic and specific concepts, so that the local collections can be properly identified. Many overseas institutions have co-operated by lending specimens for study.

Taxonomic work on other groups has also been done, relative to preparation of the check list.

Development of the computer-based recall and indexing system in the Biology Branch Herbarium will be of great value in the check-list work. This system is discussed below.

THE BIOLOGY BRANCH HERBARIUM (DAR)

Nearly 1,600 were added to the Herbarium, bringing the total to over 24,000 specimens. As well as New South Wales specimens, collections were received from the University of Queensland, and from Northern Territory, Tasmania and Victoria. Also, the University of California sent a valuable collection of 244 specimens of American and European fungi.

Several enquiries on the identification of plant parasitic fungi have been received from other institutions, and the Biology Branch Herbarium has loaned specimens to several institutions in Australia and overseas.

The Feasibility Study on a *computer-based recall and indexing system* for the Biology Branch Herbarium was completed, in co-operation with the Automatic Data Processing Section of the Department. The A.D.P. Section prepared a report detailing the proposed scheme now approved by the Public Service Board.

Present work is aimed at testing the system, and preparation of the computer record will begin soon. The first step is to transfer information from the Herbarium Accession Books to punched tape and from this the magnetic tape record will be prepared. Recall of information will be available under a wide range of headings. The system will provide data on the identity, distribution, host range and other aspects of diseases in New South Wales and other States.

NEMATOLOGY

Nematode Collection and Taxonomy

Sixty-seven additions were made to the nematology collection.

Particular attention has been given to the genus *Xiphinema*, a parasitic genus. Several species of it transmit virus diseases. A new monodelphic species of the genus has been found near Gosford, associated with dieback of forest trees. A description of the new species is being prepared and studies on its host range and ecology are in progress. The work has included a study of *X. radicicola* and *X. monohysterum*, two species closely related to the new species.

A study of *X. americanum* group showed that in New South Wales it comprises three distinct species which may occur singly or as mixtures of two or all three species. The identification, host range and seasonal occurrence of these species are being studied.

Root Knot Nematodes (*Meloidogyne spp.*)

Root knot nematodes were recorded on 7 new hosts.

Studies on grasses as hosts of *Meloidogyne* species occurring in New South Wales continued. *M. incognita* matured and caused galling on 15 out of 20 grass and cereal species treated. Thus, New South Wales populations of *M. javanica* (see last year's report) and *M. incognita* resemble populations of these nematodes from elsewhere in being able to attack grasses and cereals as well as dicotyledonous hosts.

These results indicate that a period under cereals or grass may not be as effective as formerly thought in reducing populations of *Meloidogyne*, unless a grass which is in fact a non-host is used.

Investigation of the outdoors overwintering of *Meloidogyne* spp. at Rydalmere is now entering its second winter. At the start of the 1970 winter there was a high carryover of eggs and a low carryover of larvae in the soil. By contrast, in the 1969 winter there was a large carryover of soil larvae. Differences in autumn temperatures may account for this.

Cereal Cyst Nematode (*Heterodera avenae*)

Relationships between numbers of cereal cyst nematode and the yields of wheat, oats, and barley were studied in trials at 2 sites at Koraleigh. Trials are being done in plots at Rydalmere to determine whether populations of the nematode from different farms have the same or different host preferences.

A report on the need for quarantine measures against this nematode was prepared for the Chief, Division of Plant Industry and the Chief Quarantine Officer (Plants).

Stubby Root Nematodes (*Trichodorus lobatus*)

Definite evidence was obtained that this species can cause stubby root of citrus seedlings. The nematode is common in the Gosford district where stubby root of citrus has been known for many years. *T. lobatus* is known only in Australia. Its pathogenic capabilities have not been demonstrated before.

Biology Branch—Bacteriology Section

DAIRY BACTERIOLOGY

Seminars, Conferences, Lecture Courses, etc.

Officers of the section attended the Factory Managers and Secretaries Annual Conference and the Senior Dairy Officers Conference.

Special Bacteriologist Dr Richards attended the Australian Dairy Produce Board Seminar in Melbourne, in December, 1969. He was elected Federal President of the Australian Society of Dairy Technology for 1970–71 at the Federal Council Meeting in Tasmania, in June, 1970. He attended meetings of the Standards Association of Australia as the Department's representative on S.A.A. Committee DS/3—"Microbiological Standards for the Examination of Dairy Products". Also, he acted as Chairman of the Science Subject Advisory Committee for the Food Science Board of Studies designing new curricula for Hawkesbury Agricultural College.

Bacteriologist Miss Hamill conducted practical sessions at a Meat Quality School organized by the Australian Meat Board; at Hawkesbury Agricultural College in May, 1970. She was elected as State Editor of the *Australian Journal of Dairy Technology*.

Starter Cultures

The Bacteriology Section continued to supply starter cultures for cheese, yoghurt, and other cultured milk products to the New South Wales dairy industry. This year, 2,261 starter cultures were supplied; an increase of 277 on last year's total. Standards of propagating and handling cultures in factories are improving, but a few factories still lack the necessary laboratory facilities.

Butter Quality

Biological analyses of manufactured bulk butter consigned from country factories to the Central Grading Floors in Sydney, Granville, Blacktown, and Newcastle were done in the main producing months from September, 1969, to April, 1970.

In all, 821 samples were analysed for 5 different microbiological counts. The results, with brief comments on possible sources of contamination, and recommendations for improvement, were sent through the Division of Dairying to the District Dairy Officers and Factory Managers.

Overall percentage of satisfactory samples showed a slight decline from that of the previous year. But percentages of samples satisfactory in individual counts were good, and only a few factories now seem to have major problems.

Biological quality of retail print butter in country areas was surveyed. This involved 66 samples. Samples purchased in different country centres by District Dairy Officers were sent to the butter graders of the Division of Dairying for organoleptic evaluation, as well as to the Bacteriology Section for microbiological analysis.

This type of survey is designed to assist the processor, distributors, and retailers of butter to maintain butter quality until the product reaches the consumer. Percentage of samples satisfactory in all counts used was the highest yet recorded.

Several surveys of butter processing plants were done. Samples to be microbiologically analysed were taken from each stage of the processing. As far as possible, one sample was followed through each mechanical operation. The results indicate areas where improvements could be made in cleaning and sanitising of equipment and in the hygiene of factory personnel.

Biological Cheese Quality

The section continued its bacteriological analyses of cheese produced in New South Wales. Cheese samples taken once a month by the District Dairy Officers are analysed for coliform and staphylococcal contamination. Overall cheese quality has improved since the last survey, but is still not at a satisfactory level.

Imported Cheese Survey

This project is co-operative with the Divisions of Animal Industry and Dairying. Duplicate samples of imported cheeses are taken, on arrival in Sydney, by officers of the Animal Quarantine Section. One is sent to this section for bacteriological analysis. The other is sent to Hawkesbury Agricultural College for chemical analysis.

To date, 279 samples have been analysed for the presence of coliform organisms and staphylococci. Eighty-nine (31·9 per cent of samples tested) showed the presence of staphylococci. Five of the isolates were coagulase-positive. Fifty-two (18·6 per cent of samples tested) showed the presence of coliform organisms. Twenty-four of the samples tested showed both staphylococci and coliforms.

The project is continuing until enough samples have been received from each exporting country.

Antibiotics in Dairy Produce

The programme started in 1967 has been continued. Additional antibiotics used for treatment of bovine mastitis have been tested in excretion trials, in conjunction with Glenfield Veterinary Research Station, to determine how long after infusion the antibiotic is in the milk of treated animals.

Antibiotics tested were chlortetracycline (aureomycin) and sodium cloxacillin (orbenin L.A.) The recommended withholding time for milk from animals treated with aureomycin was not stated by the manufacturer. The excretion time of cloxacillin in milk from treated animals exceeded that recommended by the manufacturer. Work will be continued next year on other antibiotic preparations.

Several preparations for control of bloat in dairy cattle were suspected of causing inhibition in milk as judged by the bromcresol purple test (BCP). One preparation was shown to cause inhibition when used in high concentration but not when administered to dairy cows in the recommended ways (drenched or painted).

Mastitis Control Programme

This programme, conducted jointly by the Divisions of Dairying. Animal Industry, and Marketing and Agricultural Economics, the Biometry Branch, and the Biological and Chemical Research Institute, started in January, 1969. The Bacteriology Section is responsible for the bacteriological analysis of milk samples from selected central coast herds, and the subsequent testing of bacterial isolates to the antibiotics recommended for use in the programme.

During the base period where all quarters in each herd were bacteriologically examined, 3,364 samples were analysed. Of these, 966 (28·7 per cent) showed growth of mastitis pathogens. Growth of other organisms was recorded but was not considered significant.

During the next 3 visits of the control period, samples were only taken from cows showing a positive reaction to the Rapid Mastitis Test. Of 1,317 samples tested, 619 (47·0 per cent) showed growth of mastitis organisms.

After the programme had been in progress for 1 year, each quarter in each herd was again bacteriologically tested. Of 1,707 samples tested, 254 (14·9 per cent) showed growth of mastitis pathogens. Compared with the base period, this shows a drop of 13·8 in the percentage of milk samples containing mastitis pathogens (i.e., about 50 per cent decrease in pathogen incidence).

Because of the control programme, the average percentage of positive Rapid Mastitis Tests in these herds has dropped from 37·2 per cent to 19·6 per cent. Sampling will continue at 3-monthly intervals for at least 1 more year.

Other Services

Biological defects in food and other products have been investigated. Samples analysed include yoghurt, goat's milk, continental cheeses, and cosmetics.

SOIL BACTERIOLOGY

Nitrogen-fixing Ability of Subterranean Clover Varieties Selected for Low Aestrogenic Isoflavine Content

High isoflavine levels interfere with sheep fertility, and a number of plant breeding programmes are designed to overcome this problem. A number of promising selections have been screened in order to find whether there is relationship between isoflavine content and nitrogen fixing ability. No evidence was found that isoflavine levels are related to ability to fix nitrogen. But there was evidence that these selections were variable as far as nitrogen fixation is concerned, and promising lines should still be screened for this attribute before commercial release.

Root-nodule Bacteria and Pelleted Tropical Legume Seed

Investigations to determine the influence of the kind of pelleting material on survival of root-nodule bacteria, on pelleted tropical legume seed, have been started. Results have shown that it is difficult to predict either the survival of the bacteria in the pellet or the influence of pelleting material on field nodulation.

Seed Dressing Insecticides and Associated Inoculation

A number of the insecticides introduced in recent years have been tested to determine their possible suitability as seed dressings in association with inoculation with root-nodule bacteria. As yet, no compatible insecticide has been tested.

Suitable Root Nodule Bacteria for Soy-Beans

Increasing interest in soybean production in New South Wales has indicated a need for selection of efficient root-nodule bacteria. A number of field experiments have been conducted. As a result, firm recommendations have been made as to suitable root-nodule bacteria for some specialized varieties.

Legume Inoculant Quality Survey

One hundred and five peat inoculants were purchased in New South Wales shops and tested for number of rhizobia. Eighty-nine per cent were satisfactory.

Entomology Branch

GENERAL

Chief Entomologist Currently Overseas

Mr G. Pasfield is overseas from 10th May to 11th September, 1970. He is studying trends in the control of insects in U.S.A., Canada, England, Europe, Ethiopia, and South Africa; also attending in London during July the 9th Commonwealth Entomological Conference, the International Study Conference on the Current and Future Problems of Acridology, and the Commonwealth Agricultural Bureaux Review Conference. In the U.S.A., Canada, and England he is observing regulatory procedures in pesticide registration and the subject of environmental contamination by pesticides. The Argentine ant problem in U.S.A. and South Africa, and the organization of locust control campaigns in the Middle East and Africa will also be studied.

Deputy Chief Entomologist in Australian Delegation Overseas

Dr G. J. Shanahan was in the Australian delegation to a Symposium arranged by F.A.O. on "Resistance of Agricultural Pests to Pesticides"; in Rome, September, 1969.

Commonwealth and State Entomology Committee

This Committee was inaugurated at meetings in Sydney during October and November, 1969. Chief Entomologist Mr Pasfield was Chairman of the meetings.

Australian Applied Entomological Research Conference

The first such conference was held at Newport, 3rd to 7th November, 1969; attended by about 100 delegates. Sir Vincent Wigglesworth, retired Cambridge Professor of Biology, and Director of the Agricultural Research Council Unit of Insect Physiology, was guest delegate. He presented a paper "Insect hormones and pest control". Pre-conference, the delegates visted the Entomology Branch on 3rd November, 1969.

SOME OF THE ACHIEVEMENTS OF PROGRESS

The year's activities yielded, *inter alia:*

- information on the flight behaviour of the Australian plague locust *Chortoicetes terminifera* in far western areas;
- definition of problems associated with laboratory culturing of Australian plague locust;
- demonstrated effectiveness of ultra-low volume aerial applications of fenitrothion against flying swarms of Australian plague locust;
- diagnosis of non-specific maldison resistance in the rust-red flour beetle *Tribolium castaneum* in samples intercepted in quarantine;
- determination of the distribution of dieldrin resistance on the banana weevil borer *Cosmopolites sordidus*;
- improvements to the reference collection of mites, including Tetranychid mites;
- no new infestation of Argentine ants observed by surveying; and
- demonstration that larval selection-pressure from either diazinon or butacarb gives stable resistance-levels in closed cultures of the Australian sheep blowfly *Lucilia cuprina*.

SOME CURTAILED OR SUSPENDED ACTIVITIES

The year included also the suspension or curtailment of some fields of investigation, as follow:

- the search for alternatives to counter the problem of dieldrin resistance in banana weevil borer *Cosmopolites sordidus* has been deferred until an entomologist is transferred to Alstonville Tropical Fruit Research Station;
- citrus pest investigations in part were again in suspension because of Mr J. G. Gellatley's engagement on administrative duties as Acting Deputy Chief Entomologist for much of the year;
- investigations on earth mites did not proceed in the winter of 1969, pending training of an entomologist for this work;
- bio-assay tests were interrupted when Entomologist Mr B. C. Gall was transferred to the National Parks and Wildlife Service and the securing to a suitable replacement Technical Officer was delayed.

PASTURE AND FIELD CROP PESTS

Australian Plague Locust

The threat of a large outbreak of locusts in central western districts was realised in the spring and early summer. Many hundreds of hopping bands, and flying swarms later, appeared in an area bounded by Peak Hill, Trangie, Coonamble, and Dubbo.

Heavy hatchings occurred in September and October and many large bands developed, particularly in the northern section of the infested area. October and early November were very wet, with local floodings, and reduced the effect of control action against hopper bands. Fledging continued for several weeks so that locust populations were not well synchronized.

Flights of adults started in mid-November and continued until mid-December. On some days there was massive flight activity but migration of swarms was limited to a few miles. This extended the boundaries of the infestation slightly to the east and north.

An extensive aerial spraying campaign to control flying swarms was conducted by the Department. Locusts matured early and significant numbers of eggs were laid.

Locust swarm activity also occurred in the Mudgee and Merriwa districts in the central tablelands during October-December. Localized areas supported numbers of hopper bands. These had hatched from overwintering eggs laid by loosely aggregated swarms in the previous autumn. Local control action effectively prevented further extension of the infestation. Elsewhere in the State locust activity was only minor in this period.

Maps drawn from extensive autumn 1969 surveys, and correlated with known weather sequences, accurately predicted the extent and intensity of these swarming locust populations throughout New South Wales.

Hatching of the second generation in the central western region started in late December but was on a very reduced scale. Many eggs were parasitized by the wasp *Scelio fulgidus* and the second generation nymphs and adults were also attacked by Tachinid, Sarcophagid and Nemistrinid parasites. By February, 1970 only low to moderate densities of adult locusts were apparent throughout the region despite excellent seasonal conditions.

Aerial surveys of the far west in March, 1970 revealed that large swarms had that month crossed into New South Wales from Queensland, on a very broad front extending from the South Australian border to the Darling River. Swarms penetrated the Milparinka and Wanaaring districts but met extreme drought conditions and many locusts died. However, localized mid-March storms permitted some survival and further flights. Thus, by late March, egg-laying swarms were along the Darling River near Louth and Tilpa.

Local reports indicated that locusts were present in numbers as far south as Cobar and extended towards Ivanhoe. This could well represent the southernmost penetration by invading swarms. At the same time local breeding occurred in the Bourke and Brewarrina districts and flights from these areas may have augmented the invasion by swarms from Queensland.

In preliminary trials in October and November, 1969, diazinon, naled, fenitrothion, and technical maldison were used with misting machines against locust bands. Each showed promise against hopper bands, but due to extremely wet weather the results were not fully assessed. Technical naled, applied with a small "Turbair" misting machine, gave excellent control of a band of 5th instar locusts at about 6 fl oz/acre.

A large and dense migrating swarm was treated with 8–10 gallons of technical fenitrothion from the air in November, 1969. Control was excellent and an estimated 35×10^6 locusts were killed within 24 hours of treatment; a further $8{\cdot}7 \times 10^6$ locusts were killed by residual action during the next 11 days. This represents, per lb of technical fenitrothion, from 330,000 to 420,000 locusts killed.

In December, 1969, an aerial spraying trial in co-operation with a commercial firm used carbaryl ("sevin-4-oil"). A settled swarm was sprayed late in the afternoon. Approximately $11 \cdot 5 \times 10^6$ locusts were killed within 24 hours and a further 3·9 million locusts by residual action over the next 2 to 4 days. Some 244,000 locusts were killed per lb carbaryl applied. There are formulation difficulties but this insecticide shows promise.

Locust activity and movement in central western districts during the period October–December, 1969 were recorded in detail. Then the second locust generation in the region during February–April, 1970 was quantitatively surveyed. Thus the fluctuations of locust numbers are well known in detail from 1965 to 1970; a period representative of locust build-up from very low numbers (in 1965) to an outbreak level (in 1969). The mass of reports and field observations for 1969–70 have been collated and put onto maps for analysis.

A number of new series of locust speciments were collected during the season to determine phase-status. The central western outbreak gave opportunity to obtain locusts from swarms with a well-documented history of pronounced gregarious behaviour.

The patrol service obtained detailed and accurate information on locust activity, particularly in early stages of outbreak when precise knowledge of movement is most needed.

Besides general scouting during the central western outbreak and continuance of the quantitative surveys from previous years in that region, the Locust Patrol Officer did several aerial surveys of far western districts.

Wingless Grasshopper

Dense populations of *Phaulacridium vittatum* were not of such widespread occurrence as in the previous season. Only localized damage occurred, in parts of the Monaro tableland and at Perthville during January and February, 1970. Good summer rainfall in tableland areas did not favour development of the hoppers. It kept damage to a minimum.

Spur-throated Locust

Scattered adults of *Austracris guttulosa* were in greater numbers than usual in the central and north west during autumn, due to the excellent summer season there.

Black Beetle

In the southern half of the Coastal Division there was no reported damage to crops or pasture by *Heteronychus arator*. In the Manning Valley there was little damage in October and no complaint of the pest's activities in any other month. In Macleay River districts the beetles were plentiful in grassland in the spring but damage was negligible, and no summer or autumn activity of the pest was recorded there.

Some infestations occurred during October, December, January, and February in the region comprising the Clarence and Richmond River Valleys. No pasture damage was reported and any effect on crops was relatively insignificant.

The general low incidence of black beetle damage to crops in coastal New South Wales during 1969–70 is thought to be largely due to (i) the abnormally wet spring of 1969, and (ii) the cumulative effect of incorporation of soil insecticides in cultivation paddocks through the years.

Co-operative with Grafton Agricultural Research Station, a field experiment on maize investigated the relative effectiveness of insecticides drilled into the soil through a planting machine. The materials, mixed with superphosphate and applied during the plantings, were: methidathion, carbaryl, diazinon with detergent, methoxychlor and dieldrin. The control plots were planted with superphosphate.

During this trial the black beetle activity was insufficient to yield conclusive evidence on the protective value of the various insecticides. But the useful information obtained was that none of the 5 treatments produced any observable symptom of phytotoxicity in the maize.

Seed-harvesting Ants

No report of seed-harvesting ants causing interference with aerially-sown pastures was received, and no field infestation of sufficient size to justify field trials was located. In the Bathurst-Rockley district during early May, 1970, various areas which had carried an abundance of *Pheidole* seed-harvesters in 1967–68 were surveyed. Only one showed any sign of surface activity by such ants, and that infestation was negligible.

Wet soils and unseasonable cold weather in early May apparently depressed surface activity by the pest species. Also, it appeared likely that harvester-ants on the central tablelands had already accumulated enough seed in their underground storages from the exceptionally luxuriant vegetation (pasture and weeds) during the outstandingly good seasons in the preceding 18 months.

Amnemus Weevils

Under field conditions it was confirmed that *Amnemus quadrituberculatus* adults remain in the base of the pasture sward by day and move to the tops of the plants by night in the summer period.

Observations in 1968–69 had indicated that the vertical movement of *Amnemus* was a negative phototaxis. But adults, although attracted to an incandescent bulb in laboratory experiments, distributed themselves randomly when exposed to a cold light source.

Humidity levels in the sward have been found to be a more likely cause of *Amnemus* movement. In small humidity-gradient chambers, adults chose the higher relative humidity regions under both light and dark conditions. In the field there appears to be an interaction effect, between humidity and temperature, on *Amnemus* behaviour.

Nineteen District Agronomists and Dairy Officers co-operated for a survey to define geographical distribution of *A. quadrituberculatus* and *A. superciliaris* throughout the coastal area north of Macksville. Eighteen groups of specimens were received, from January to March, 1970. Both species were represented but all were from areas where the insects had been previously recorded.

Legume defoliation by *Amnemus* adults was of little concern, due to the good 1969–70 summer conditions which led to excellent pasture legume growth throughout most of the far north coast.

Soil was sampled for larvae at 4 sites established in 1966 and 1967 to test the long-term effectiveness of "pre-sowing treatments" with dieldrin. Dieldrin at ½, 1, and 2 lb/acre rates continued to give good control of larvae at 2 sites on chocolate basalt-chocolate alluvial soils. On a red soil site, larval survival was significant at all treatment rates. Lacking untreated control plots, this site was discarded. At the fourth site, on chocolate alluvial soil, legume disappearance is thought to have been caused by very dry conditions. No larvae were found during the sampling.

Heptachlor, applied to a chocolate basalt soil at 1 lb/acre, again gave control equivalent to that from a similar rate of dieldrin. At 1 site on chocolate alluvial soil dieldrin at ½ lb/acre, although it had given excellent control for the previous 2 years, showed decreased effectiveness in the third year of sampling. The ½ lb rate allowed survival of significantly more larvae than did 1 and 2 lb of dieldrin/acre.

Legume plant densities were estimated in all plots at the 4 sites. Correlations between amount of insecticide applied and persistence of the legume were significant at a site on chocolate alluvial soil where plots containing dieldrin at rates of 0, ½, 1, and 2 lb a.i./acre had respective legume plant density of 7·5, 17·9, 19·9, and 24·2 plants/sq yd. No such correlation was found at the red basalt site, while extreme "between-plot" variation at the chocolate basalt site makes a correlation doubtful.

Red-legged Earth Mite

A replicated screening trial was established against *Halotydeus destructor* on Wagga Agricultural College in early June, 1970. The insecticides dursban 1 oz, mecarbam ½ oz, methidathion ½ oz, methoxychlor 4 oz, and omethoate ½ oz/acre are being tested against DDT 2 oz, dimethoate ½ oz, and imidan ½ oz/acre. A boom spray delivering 15 gallons of insecticidal fluid/acre was used. Each spray was prepared from an emulsion concentrate. The site was well covered by a dense pasture sward with high content of rye grass.

Autumn rain favoured a good hatch of over-summering eggs. There were high numbers of mites by mid-May. The first generation population-peak of adults occurred in early June, when the experiment was started. Nymphal stages predominated by late June.

Four weeks from start of the trial the level of control by methoxychlor compared favourably with DDT. Others effectively controlling the pest at this stage are: dursban, imidan, methidathion, and omethoate. High numbers of nymphs are in the control and dimethoate and mecarbam plots.

Pasture-yield cuts are being taken to assess the effect of chemical control of *H. destructor* on subsequent pasture growth.

Blue Oat Mite

A screening trial was started against *Penthaleus major* in the Goulburn district in mid-June, 1970; comparing dursban at 1 and 2 oz/acre and methoxychlor at 1, 2, and 4 oz/acre respectively with DDT at 2 oz/acre. The trial is in a good stand of Algerian oats sod-seeded into natural pasture. A boom spray delivering 15 gallons per acre, as emulsions, was used.

A high population of mites, adults, and nymphs, was present at time of treatment. Two weeks from spraying DDT and dursban were affording control whilst methoxychlor was ineffective.

Despite high numbers of mites in untreated plots the oat crop is not showing damage. Blue oat mite is a pest of oats in the seedling stage. Peak numbers of the mite possibly did not develop until the crop was firmly established.

Spine-tailed Weevil

Larval stages of a native weevil *Desiantha caudata*, known also as the "cereal curculio" in Victoria and South Australia, attacked wheat and barley seedlings at Henty in July, 1969 and barley seedlings at Mayrung in August. The larvae have only been recorded as a pest of newly sown wheat and barley in the southwest of the State, and in every case the cereals were sown—without an intervening fallow phase—into ground carrying subterranean clover established from 4 to 9 years and ploughed late in the season. Losses range from 30 to 70 per cent of the sown area but a complete loss of crop may result.

Lucerne Seed Web Moth

The *Etiella behrii* caterpillars were no problem in lucerne seed crops in the Lachlan Valley area this season. There were 2 verified reports of minor infestations only; in the Dubbo district during February.

Cotton Insects

Thrips tabaci.—The cotton seedling thrips attack on seedlings was heavier and it continued longer than in previous seasons—with the earliest sown stands showing leaf malformation at about 4 weeks. Several growers applied DDT at 1 lb a.i./acre in an attempt to lessen the damage. By late December, both sprayed and upsprayed crops appeared to have outgrown the damage and were growing vigorously.

Austroasca spp.—Small numbers of jassids, especially cotton jassid *A. terraereginae*, were noted during the seedling phase but damage was insignificant.

Crocidosema plebeiana.—Attacks by cotton tipworm on some crops in early December gave about 2 per cent malformed plants.

Heliothis punctigera.—The common bollworm first appeared towards the end of December. But the build-up was not great, because rainy and windy conditions limited egg-laying during early flowering. Occasional crops were heavily infested; mid to late January and again in late February. In general, *Heliothis* infestations were lighter than normal and the number of DDT sprays applied was about one third less than in the previous season.

A trial of carbaryl as a possible alternative to DDT for *Heliothis* control, gave a negative result. Performance of carbaryl was not improved by adding molasses as a bait, to poison moths before eggs are laid.

Earias huegeli.—Rough bollworm was more active than for the past 5 seasons. Occasional stem-boring larvae were noted late in November. By late January, larvae were frequent in squares and flowers. The pest remained in crops throughout the rest of the season despite repeated endrin applications. However, many of the damaged bolls were set too late to reach maturity. Some of the larger bolls that would have matured were entered by larvae late in the season. Fungal and bacterial boll-rots then caused complete loss of such bolls.

Aphis gossypii.—Cotton aphids were active from late January until the end of the season. Wet and windy conditions during December and January suppressed development of their natural enemies.

Plusia argentifera.—Tobacco looper had caused foliage damage to cotton over the last 3 seasons, but scarcely appeared in cotton crops this season. Damage was insignificant.

Tetranychus ludeni.—Spider mite was prevalent late in the season, especially west of Wee Waa. Some growers had difficulty in controlling them with organophosphorus miticides.

Cotton Pest Investigations at Narrabri Agricultural Research Station

Common Bollworm.—Cotton plots sown in October, November, and December, were closely observed throughout growth for pest incidence. The observations confirmed that infestation by common bollworm starts at the initiation of squaring, continues during the flowering phase, and is not related to a particular month of the year.

Seedling Thrips.—Infestation by seedling thrips in cotton's early growth stage often causes concern to growers. Trial sprayings of heavily infested seedling stands with varying rates of DDT gave excellent control of the thrips. But subsequent measurement of plant heights, flowering dates and lint yields showed that protection from thrips did not improve the rate of growth or maturation or influence the yield.

Aphids.—Mid-season application of DDT spray gave an upsurge in aphid numbers within a week, but re-invasion by natural enemies of aphids soon reduced aphid populations to a low level. Aphid build-up late in the season was noted. It followed a reduction in natural-enemy activity, through cool weather.

"*Strategic*" *Spraying.*—Trials to compare yields from plots treated with: a commercial spray programme of 8 sprayings; 6 sprayings with DDT only; a "strategic" spraying schedule requiring only 3 sprays; alongside untreated plots; gave the following yields:

	Yield in bales per acre
Commercial schedule (8 sprayings)	1·91
Strategic spraying (3 sprayings)	1·85
DDT only (6 sprayings)	2·02
Control (no sprayings)	0·93

Between the first 3 yields the difference was not significant but each was significantly better than the untreated. This confirms earlier findings that strategic applications of pesticide will give full protection against yield loss due to insect damage.

Maize Insects

Large numbers of a small black earwig *Nalia lividipes* were seen in January and early February in young late-sown maize stands at Gunnedah, Narrabri, and Wee Waa. The insects concentrated within the seedlings' root zone. Many seedlings showed deep chewings into the adventitious roots; some roots were completely severed. Loss of seedlings was up to 30 per cent in some crops. By mid-February, the earwigs had practically disappeared. Where crops had to be re-sown it was not possible to assess whether surface applications of BHC prevented damage or whether seed-treatment with dieldrin had prevented a second attack.

In January, corn earworm caterpillars *Heliothis punctigera* heavily infested irrigated maize crops in the Narrabri area. In the worst cases, up to 1 cob in 3 was damaged by as much as one quarter of the grain of a cob being chewed. The caterpillar damage was often increased by fungal and bacterial cob rots. Crop loss was estimated at up to 10 per cent of grain. Aerial applications of DDT and endosulfan gave only partial control.

Sunflower Insects

Rutherglen bug *Nysius vinitor*—a major pest during the 2 previous seasons due to climatic conditions favouring this insect—was not a pest of any consequence in the much reduced area planted to sunflower in the Namoi Valley in the 1969 spring. No other economic insect was present in sunflower crops.

Soybean Insects

Plantings of irrigated soybeans over wide areas of northwestern and centralwestern districts including the Gwydir, Namoi, and Macquarie River Valleys were observed for pest incidence.

Grass blue butterfly *Zizeeria otis labradus* caused minor damage in experimental plots at Narrabri Agricultural Research Station early in the season.

Tobacco looper *Plusia argentifera*, soybean moth *Stomopteryx simplexella* and lucerne pod-borer *Etiella behrii* did not appear in effective numbers.

Green vegetable bug *Nezara viridula* built up from late January onwards at Moree, Narrabri, and Narromine. Control was good with methyl parathion sprays. Another shield bug, the brown *Dictyotus coensus*, was common in crops in these districts but its pest status is not known. The upsurge in shield bug numbers probably resulted from lower levels of the shield bug egg-parasite *Trissolcus basalis*.

Linseed Insects

Native budworm *Heliothis punctigera*, the main pest of linseed, infested crops in the early flowering phase. It was adequately controlled by DDT applications. No other pest caused concern.

Grain Sorghum Insects

There were isolated cases of attack by common armyworm *Pseudaletia convecta* in grain sorghum at Narrabri in December and early January. Damage was usually slight and insecticide application not warranted.

Sorghum midge *Contarinia sorghicola*, favoured by high humidity conditions from frequent rainfall in mid-summer, became very active from early February onwards. This was throughout the northwest and almost all late flowering crops from Wee Waa eastwards were infected. In 1 crop, over 100 ovipositing midges were observed attacking single flowering heads late in February. Due to anticipated low returns, and a need of repeated applications, many growers did not spray. In instances of spraying, 2 or 3 treatments with DDT or DDT plus maldison were needed because of rapid re-infestations by large numbers of the midge.

Bloodworms

Surveys in Leeton district through winter and spring, in pasture land before rice sowing, showed that bloodworm incidence was less than average. The wet autumn, winter, and spring reduced the range of habitats for bloodworm development; temporary pools, favoured by bloodworms, were replaced by permanent water due to the abundant rain.

Treatment of seed with abate at 0·2 oz and 2 oz/100 lb seed and dursban at 4 oz/100 lb of seed were effective against bloodworms. Plant stand and yield were increased by use of the insecticides at those rates.

FRUIT TREE PESTS

Two-spotted Mite

Peaches and a Systemic.—Investigations of aldicarb soil treatment to control two-spotted mite *Tetranychus urticae* were continued at Yanco Agricultural College and Research Station.

Aldicarb in granular formulation was applied at 0·1 and 0·2 oz a.i. per inch of trunk diameter. The granules were applied in December and immediately taken into the soil by irrigation water. For comparison, a number of trees were thoroughly sprayed on the same date with a standard miticide (oxythioquinox 0·0125 per cent), and other trees were left untreated.

On untreated trees the mites averaged more than 40 per leaf for upwards of 80 days and caused severe bronzing and dropping of the leaves.

Each aldicarb treatment gave satisfactory seasonal control. The 0·2 oz treatment was superior. It kept mite numbers below 6 per leaf for the entire post-treatment period and prevented leaf damage. In the 0·1 oz treatment, mite numbers did not exceed 9 per leaf during the post-treatment period and leaf damage was only minor.

Two applications of oxythioquinox were necessary for control approximating that given by the aldicarb treatments.

Apples and a Systemic.—During November and December, 1969, observations were made at Bathurst Agricultural Research Station on the effect on 2-spotted mite of benomyl 0·025 per cent. This was applied to Jonathan apple trees 4 times at approximate 14-day intervals for control of powdery mildew. The effect of wettable sulphur 3 lb to 100 gallons and of binapacryl 0·05 per cent, applied on the same dates as benomyl, were also observed. (Wettable sulphur is known to have a mild suppressive effect on 2-spotted mite, and binapacryl is a widely-used and very effective miticide.)

Trees sprayed with wettable sulphur averaged 3·7 mites per leaf during the observation period. This was a considerable population for early in the season. Trees treated with binapacryl carried 0·15 mites per leaf, while benomyl-sprayed trees had an averageof 0·85 per leaf.

These results indicate that benomyl, as used to control powdery mildew, exerted a useful suppressive effect on 2-spotted mite during the November-December period but was not as effective a miticide as binapacryl.

Integrated Control of Apple Pests

A *Co-operative Programme of Research on Pest Management in Pome Fruit Orchards* has been conducted from 1966 to 1969 in collaboration with the Departments of Agriculture of South Australia, Tasmania, and Victoria, and the CSIRO.

The programme showed that infestation by a particular 3 apple pests could often be kept below an economically important level by their natural enemies, provided that commercial broad-spectrum insecticide programmes were suspended. The 3 pests are: two-spotted mite *T. urticae*, woolly apple aphid *Eriosoma lanigerum*, and light brown apple moth *Epiphyas postvittana.*

The Programme also showed that certain other pests (e.g. plague thrips *Thrips imaginis*, apple dimpling bug *Campylomma livida*, and probably San Jose scale *Quadraspidiotus perniciosus*) were not amenable to control by natural enemies and that insecticides would have to be used against them in some seasons.

Following upon these findings, an investigation was started at Bathurst Agricultural Research Station to determine the effect of pesticide applications (as applied to control plague thrips, dimpling bug and San Jose scale) upon the important natural enemies of 2 spotted mite, woolly apply aphid, and light brown apple moth.

DDT 0·1 per cent applied (i) at pink stage, (ii) at full bloom and (iii) at both pink and full bloom, and dormant oil 3–100, applied in the winter, reduced the numbers of natural enemies in comparison with populations in an untreated check plot. That effect was particularly noticeable on the more sedentary forms, such as spiders and predatory mites.

However, all beneficial forms regenerated satisfactorily in the absence of further applications of commercial insecticides—with the exception of predatory mites in the plot receiving DDT at pink and again at full bloom. In this plot, predatory mite numbers remained low until late in the season. Then they rose to a level comparable with that in the other plots.

In none of the plots treated with the above insecticides did the level of infestation by woolly apple aphid and light brown apple moth rise above that in the untreated plot. Infestation by woolly apple aphid was commercially insignificant in all plots. But infestation by 2-spotted mite, although commercially unimportant, was higher in the plot which received DDT at both pink and full bloom than in the other plots. Possibly this was due to the scarcity of predatory mites in the plot given those 2 DDT treatments.

The results in this first season, 1969–70, suggest that in the absence in summer of broad spectrum sprays (needed to control codling moth) the application of DDT (specifically aimed at plague thrips and apple dimpling bug) and of dormant oil (specifically aimed at San Jose scale) may not seriously affect the biological control of 2-spotted mite, woolly apple aphid and light brown apple moth.

Plague Thrips

An investigation was made in Bilpin district in late winter and early spring to determine the host plants that enable plague thrips *Thrips imaginis* to develop. The pest has caused much difficulty for apple growers there in recent seasons.

Adults and their larval progeny were observed during August and early September, 1969; on Sydney golden wattle *Acacia longifolia*, on myrtle wattle *Acacia myrtifolia*, on Japanese plum *Prunus* sp., and on wild radish *Raphanus raphanistrum*—a frequent weed in orchards. *A. longifolia*, because of abundance in the district and profusion of blossom, is probably the most important host enabling early season build-up of plague thrips.

Conditions favoured thrips increase on those host plants during August and early September. A big emergence of second generation adults followed a few warm days in early October, when apples were at early blossoming. Apple blossom was severely damaged where not insecticidally treated.

The observations in Bilpin district showed that infestation of an orchard could result from immigration of adults that had their immature stages on host plants outside the orchard.

A survey to determine the identity of thrips present in apple blossom was made in the Orange, Bathurst, Bilpin, Yanco and Leeton districts. Plague thrips was the only species infesting and damaging apple blossom. One or two other species were in trace numbers.

Apple Malformation

At Bathurst Agricultural Research Station the relationship between populations of apple dimpling bug *Campylomma livida* during the blossoming period and the extent of fruit malformation in Granny Smith apples was examined. Populations were low through the blossoming (averaging about 7 bugs/100 blossom clusters) but increased considerably after petal fall. An average of 21 bugs/100 blossom clusters was recorded 11 days after petal fall.

Fruit damage was very light; only 2·5 per cent of fruits showed any malformation at harvest. Malformation also was very slight; 70 per cent of affected fruit classed as Fancy Grade; a further 20 per cent as Good Grade. Thus, economic loss due to the bug was negligible.

Apple Root Weevil

Part of a long-term trial at Batlow concerned with effect of apple root infestation by *Perperus languidus* larvae has ended. Two series, each of 30 trees planted in 1963, were dug up in September, 1969. The root systems were examined, trees weighed and trunk circumferences measured.

One series had been in land from which old apple trees heavily infested by root weevil were removed just before the replantings in 1963. In this area weevil infestation was almost eliminated by dieldrin treatment.

The other series had been in similar land but with no attempt to control the weevil. The examinations and measurements showed that growth of these trees planted into infested, old apple land was severely restricted by the pest; much inferior to that in the series where weevil infestation had been excluded.

In the continuing section of the trial, two series, also of 30 apple trees each and also planted in 1963, are in land that was under pasture for eight years after previous apple trees were removed. In one series weevil infestation has been almost eliminated by a dieldrin treatment. In the other series the infestation has not been controlled.

So far there is no significant difference between growth rates in the 2 series as measured by trunk circumference and weight of fruit harvested.

Dried Fruit Beetles

Trapping of adult dried fruit beetle *Carpophilus* spp. in syrup-lure traps was continued in a Leeton stone fruit orchard. High numbers were taken from October to December. The population thereafter remained low. Little damage by these pests was apparent at harvest.

Banana Weevil Borer

All banana districts were surveyed for extent of distribution of dieldrin resistance in banana weevil borer *Cosmopolites sordidus*. (Resistance had been first discovered in the Brunswick district late in 1968.) Samples of live weevils were collected in the field and sent to Rydalmere for laboratory tests. Of 125 weevil samples evaluated, 60 had a high order of dieldrin resistance, whilst the 65 others were susceptible.

All of the resistant samples were taken in the Brunswick District, centred in the Main Arm of the Brunswick River, including the localities: Upper Main Arm, Main Arm, Cooper's Lane, Palmwoods, The Settlement, The Pocket and Middle Pocket; and in Mullumbimby and Wilsons Creeks; a total area of approximately 40 square miles.

Outside this area no collected sample showed sign of dieldrin resistance and the pest was controlled by the recommended dieldrin treatment.

Laboratory work in a search for an alternative chemical for use on plantations infested with dieldrin-resistant weevils has shown two promising compounds worthy of field-testing; chlordecone and chlorfenvinphos.

Fruit-spotting Bug on Avocado

Initial observations on the bug *Amblypelta nitida* attacking avocado have shown that both the nymphal and adult stages puncture the skin and make the fruit unmarketable. A star-shaped cracking of the skin appears when the fruit is punctured early in development; a sunken blackish spot from puncture of well-formed fruit; in both, a hardened "marble" forms in the flesh around the puncture.

Inspections of affected orchards indicate that the bugs, which feed on a wide range of hosts, invade from neighbouring scrub. Also, that a large number of fruits may be spoilt by prolonged feeding of few bugs. Often, more than half of the fruit on one tree may be ruined whilst fruit on all surrounding trees are undamaged.

The bugs are difficult to see. Thus the timing of spray applications is a problem. But a programme of three 0·1 per cent carbaryl sprays during the warmer months shows promise.

Macadamia Twig Girdler

Preliminary observations on the xyloryctid moth *Neodrepta luteotactella* have shown that the larvae feed either on young shoots and twigs or by mining within the leaves of Macadamias. The path of feeding is marked by a trail of frass and webbing, giving the tree an untidy appearance. Whether the quality or quantity of fruit from an old, well-established tree is affected by the caterpillars is doubtful. But young trees' development may be seriously retarded. Their growing tips are killed, as larvae often ringbark a twig as they feed. Such damage is prevented by spraying the tree with 0·1 per cent DDT emulsion.

Citrus Red Scale

In M.I.A. orchards *Aonidiella aurantii* was less active than in the previous year but infestations persisted where control recommendations were inadequately followed. Substantial infestations were seen and much fruit was blemished, especially Valencia oranges in summer and autumn.

In the west, at Bourke, there were severe infestations in commercial citrus orchards. Citrus in home gardens throughout the north west were also heavily infested.

In the Lower Murray districts, where red scale and the closely related yellow scale *A. citrina* occur together, infestations by the two were usually not at high levels.

In spraying trials in the M.I.A., promecarb 0·06 per cent plus white oil 1–100 showed promise. This was in a preliminary study initiated in March, 1969 on Valencia orange trees. In an extensive trial on Valencias, started in February, 1970, the effects of single sprays of promecarb 0·06 per cent plus white oil 1–100, and omethoate at 0·05 per cent plus white oil 1–100 and 0·03 per cent plus white oil 1–100, are being compared with recommended sprays (dimethoate 0·03 per cent plus white oil 1–100, and ethion 0·075 per cent-in-oil 1·25 per cent). Scale control has yet to be assessed. There was no tree or fruit injury.

A wasp parasite (*Comperiella bifasciata*) of red scale was again found readily in M.I.A. orchards. A trial was started in February, 1970 to assess effects of the standard red scale control sprays (dimethoate 0·03 per cent plus white oil 1–100, maldison 0·1 per cent plus white oil 1–100, ethion 0·075 per cent-in-oil 1·25 per cent, and white oil 1–50) on the wasp parasite and other beneficial insects; especially scale-eating ladybirds. Preliminary assessments have not shown clear differences in the wasp or the ladybird populations because of the sprays.

Hard Wax Scale

The area of incidence of hard wax scale *Ceroplastes sinensis*, a new pest of citrus trees, has extended. The scale was first seen in March, 1967 at West Pennant Hills. New areas include Kellyville, Glenorie and Kenthurst; heavy infestation of oranges and mandarins occurred.

Field observations confirmed that there is one main generation of scales each year, and that hatching of larvae from the eggs under the parent female scales is complete by the end of March. In general, good results have followed the recommended control measure: carbaryl w.p. 0·05 per cent plus white oil 1–100 applied at the end of March.

A life-history study was planned and to this end the scale was placed on potted rough lemon trees in the glasshouse. But infestation did not become established. Significant infestation of lemons in the field has not yet been recorded.

Morphological studies of larval and young adult stages are in hand. Permanent slide-mounts of the material have been made.

Citrus Red Mite

Citrus red mite *Panonychus citri* has been eliminated from the restricted three known areas of infestation in New South Wales; Oxford Falls, Gosford and the Royal Botanic Gardens. The infestation at the Gardens had been transplanted from Oxford Falls. Division of Horticulture field officers know the importance of this exotic pest of citrus and look for it. No further occurrence was recorded.

Queensland Fruit Fly

Incidence.—Queensland fruit fly *Strumeta tryoni* was more notable in the past season than for several previous years. Infestation was frequent in coastal, tableland and north western areas, in home gardens and in orchards, where inadequate control measures were used.

Infestations were heavy in loquats in coastal districts in September-October. Over the rest of the season pome and stone fruits, citrus and tomatoes were frequently attacked. On the northern tablelands, stone and pome fruits were infested from December onwards.

The Fruit Fly Suppression Schemes.—In towns using the schemes (based on male lure trapping and programmes of maldison plus protein hydrolysate bait sprays) generally little infestation occurred, except in several north western towns (e.g. Narrabri and Tamworth). There, fruit fly was troublesome in home gardens late in the season.

The fruit fly suppression scheme in and around the Murrumbidgee Irrigation Areas in the Shires of Carrathool, Coolamon, Hay, Leeton, Murrumbidgee, Narranders and Wade, was continued. Larval infestation was found at Narrandera for the first time in some ten years, in some home garden peach trees. Further south also, at Deniliquin, infestation of home garden peach trees was located.

Prompt action was taken by Division of Horticulture to bring these infestations under control. Because of these 2 occurrences, oranges from Leeton, Tocumwal, and Perricoota districts must now be fumigated with ethylene dibromide before export to New Zealand.

Banana Commodity Treatments.—Research into disinfestation of bananas by ethylene dibromide (EDB) fumigation and by dipping in dimethoate was continued at the Citrus Wastage Research Laboratory, Gosford.

In a survey for susceptibility to skin injury by EDB fumigation, winter bananas from Coffs Harbour (New South Wales) and Tully (North Queensland) were fumigated in open field cases or fibreboard cartons for 2 hr at 70° F; with 10, 11, 12, 13, 14, or 15 oz EDB/1,000 cu ft.

The bananas in field cases showed mainly trace-injury at 11, 12, and 13 oz and severe injury at 14 and 15 oz rates. The only fruit in the field cases completely free of EDB injury was that fumigated at the 10 oz rate.

Fruit fumigated in cartons showed less injury than fruit in field cases, and injury was first evident at the 12 oz level. Fruit from North Queensland appeared to be less susceptible than that from New South Wales, but the former sample came from only 3 growers.

Mortality studies on fruit fly eggs and larvae in artificially infested bananas, and on naked pupae, were made with EDB fumigation at 10 and 12 oz EDB/1,000 cu ft. Results, expressed as survivors from total individuals treated were: 10 oz rate—eggs 187 from 160,778, larvae 8 from 60,084, pupae 22 from 74,439; 12 oz rate—eggs 5 from 56,620, larvae 2 from 81,462, pupae 8 from 57,000.

High mortality in fruit fly eggs and larvae was attained with dips of dimethoate plus thiabendazole (TBZ). There was no survivor in 4 separate tests on eggs and 4 separate tests on larvae, each on more than 10,000 individuals, in bananas dipped in 0·05 per cent dimethoate plus 0·1 per cent TBZ for 30 sec at 70° F. Dips containing 0·03 per cent dimethoate plus TBZ also gave high levels of mortality.

Treatment of pupae by dipping in dimethoate was not effective. In 3 trials, immersion of pupae in 0·05 per cent dimethoate plus 0·1 per cent TBZ gave some 35 per cent mortality after 30 seconds immersion and some 40 per cent mortality after 3 minutes immersion. Addition of wetting agents to the dimethoate dip did not greatly improve the percentage.

White Wax Scale

Infestations by *Gascardia destructor* were generally widespread in coastal citrus orchards during 1970, following showery weather with moderate temperatures during January. These conditions favoured new generation scales and were not good for spraying.

VEGETABLE PESTS

Phytotoxicity Trial on Tomatoes

A phytotoxicity trial was conducted at Rydalmere during the late summer and autumn, to test methomyl sprays on tomatoes. Methomyl is one of the newer insecticides which may be a useful alternative to DDT for the control of heliothis caterpillar.

Rouge de Marmande tomatoes were used in the randomised trial. Materials used were methomyl at 0·0125, 0·025, and 0·05 per cent, and DDT at 0·05 per cent. Sprays were weekly, for 8 weeks, as high volume applications. Cropping was normal. No phytotoxicity was observed in any treatment.

Bean Fly

An insecticide screening trial was conducted at Terrigal in the autumn to compare spray programmes of promecarb 0·025 per cent and methoxychlor 0·05 per cent with standard recommendations (DDT 0·05 per cent and dimethoate 0·03 per cent) for the control of *Melanogromyza phaseoli*. Initially, fly incidence was low. But activity increased and led to considerable leaf and stem infestation, permitting evaluation of the treatments.

Dimethoate and DDT afforded the better protection. Dimethoate, DDT, methoxychlor, and promecarb respectively allowed 10, 20, 55, and 55 per cent plant-infestation.

STORED PRODUCT PESTS

Rust-red Flour Beetle

Maldison-resistance Survey.—A survey to determine distribution of this in *Tribolium castaneum* in New South Wales was continued. With the co-operation of Plant Diseases Act Inspectors, District Agronomists and the Grain Elevators Board, samples were secured from stock feed mills, produce stores, farms, bulk grain storages, and railway bulk-grain trucks. Export and Import Branch Inspectors also provided samples intercepted by quarantine activities in vessels and on cargo from overseas.

Thirty-two samples were collected, and established in culture for testing. Ten other samples, taken in a 1968–69 survey, were in hand for resistance studies.

In laboratory tests on 32 of the samples: maldison-resistance was diagnosed in samples from 2 more country locations in New South Wales; in 1 of 6 samples from railway bulk-grain trucks; in 3 samples from 2 premises in the Sydney metropolitan area where maldison-resistant beetles had already been detected; and in 6 of 7 samples intercepted in quarantine. Twenty of the 32 samples were susceptible to maldison.

Nature of the Resistance.—This was studied in tests with an enzyme inhibitor. The tests indicated *maldison-specific* resistance in all samples collected within New South Wales. This is in contrast to the maldison-resistance detected in some samples intercepted in quarantine. In these, *a mixture of specific and non-specific* maldison-resistance is apparent.

Standardization of Resistance Testing-Methods

At the direction of Standing Committee on Agriculture, the CSIRO convened a school on resistance testing-methods for stored-product insects at Brisbane in October, 1969. The school was attended by the Departmental entomologists from Western Australia, South Australia, Victoria, Queensland, and New South Wales engaged on stored-product insects. Object of the school was to standardize the methods used for resistance testing throughout Australia.

Aeration of Farm-stored Grain

A trial of aeration of wheat stored in farm silos without insecticidal treatment, had been started at Condobolin Agricultural Research Station in December, 1968. It ended in February, 1970. Three aeration systems were tested. The project was done in co-operation with an agricultural engineer from Division of Research Stations.

Insect infestation developed in surface grain and grain near outlets at the base of the silos. The trial showed that aeration, without grain-protectant insecticide treatment, was an inadequate preventive. Also, moisture accumulation swelled the grain in the lower part of aerated silos in the absence of humidity control.

A further aeration was undertaken, with maldison-treated wheat, in December, 1969. Different control systems, designed to limit the intake of humid air, were fitted to aeration units on 2 silos. A third silo, unaerated, was included for comparison. Grain samples were taken at intervals of 2 months; to detect insect infestation, and for analysis of maldison residue by the Chemistry Branch. Grain moisture content and temperature were also taken.

Decomposition of maldison residues in the lower part of the aerated silos was retarded by aeration. Cooling may be an explanation. Rapid decomposition of maldison seemed to have occurred in the unaerated silo soon after the treated wheat was placed in storage. High temperature of grain at the time of filling the silo is suspected of involvement.

In April, 1970, aeration was discontinued in one silo to prevent moisture uptake during winter. The temperature in the centre of the grain mass had been reduced below 18° C. Theoretically, insect activity is inhibited by this. The other silo, with a control allowing 15 hours aeration per week, was left for comparison.

In June, 1970, 6 months after the start of this trial, the wheat in the 3 silos was free of live insects. Evidence of insect invasion was that dead saw-toothed grain beetle *Oryzaephilus surinamensis* and rust-red flour beetle *Tribolium castaneum* were in samples from outlets at the bases of the two aerated silos and on the surface of the unaerated silo.

Education on Control of Pests of Stored Grain

Schools.—Anticipating a wheat harvest exceeding the capacity of the Grain Elevators Board and leaving large surpluses of grain in farm storages, a schedule of schools dealing with grain storage was organized for farmers by the Agricultural Bureau of New South Wales.

Information prepared by the Entomology Branch was presented at 14 schools in wheat-growing areas. Emphasis was on pre-harvest cleaning of and insect control in grain-harvesting machinery and grain storages on farms.

Publication.—An article dealing with those aspects was published in the *Agricultural Gazette of New South Wales* in October, 1969.

Training Course for Personnel on Handling, Storage, and Inspection of Grain.—In November, 1969, the entomologist engaged in stored-products pest work functioned as a member of the Working Party of a Committee convened (at direction of Standing Committee on Agriculture) by the Department of Primary Industry to consider the establishment of a training course for personnel involved with pests of stored grain. He investigated means and costs of publicizing a course which the New South Wales Department of Technical Education is to provide.

Maize Pests

Samples of maize cobs, from a May, 1969 survey of field infestation in the Southern, South Western and Mid Western Regions of New South Wales, were incubated for 8 weeks in the laboratory. Incubation revealed a slight infestation by Angoumois grain moth *Sitotroga cerealella* in one sample from South Gundagai.

Pests in Sheepskins

Investigations of the control of skin and hide beetles *Dermestes* spp. and ham beetle *Necrobia* spp. infesting baled sheepskins intended for overseas markets were started in March, 1969.

The outer surfaces of baled sheepskins in an experimental shipment to U.K. were treated with diazinon, fethion, baythion and dursban 1 per cent dusts, and methoxychlor 46 per cent dust. Effectiveness was evaluated by inspectors of the U.K. Ministry of Agriculture. Sheepskins were infested, irrespective of treatment. Thus, external dusting of bales was ineffective *either* against insects present inside the bales before treatment *or* against cross-infestation of the experimental consignment from other cargo.

The treatments were applied also to baled sheepskins stored at Sydney. When this trial was examined in July, 1969, 4 months after treatment, there was not enough insect activity on the outer surfaces of the bales to determine any difference between the treatments.

When container-shipment of sheepskins was introduced, exporters became interested in fumigation. Caged test insects were inserted in baled sheepskins in 2 export containers in August, 1969. One of the containers was fumigated with methyl bromide before shipment. This was part of an experimental shipment to U.K. from 3 States. Again the shipment was evaluated by inspectors of the U.K. Ministry of Agriculture. The trial failed to provide conclusive evidence of fumigation effectiveness; because of absence of significant insect infestation of the sheepskins, and death of the test insects.

ANIMAL PESTS

Primary Sheep Blowfly

Strains under Culture.—The following strains of *Lucilia cuprina* are being cultured, in seeking alternative insecticides to overcome organophosphorus (O.P.)—and carbamate-resistance in sheep blowflies.

LS:	susceptible to all insecticides.
Q:	an O.P. resistant strain cultured under larval pressure with diazinon; resistance factor of about 20 fold on early instar larvae.
RD:	a carbamate-resistant strain cultured under larval pressure with butacarb; resistance factor of about 20 fold on early instar larvae.
TDR:	a BHC-dieldrin resistant strain cultured under larval pressure with dieldrin; resistance factor 125 fold on early instar larvae.
CFS:	a combined resistant strain cultured under larval pressure with diazinon, butacarb and dieldrin—one of these insecticides being used every third generation.

Selection Response—Q and RD strains, under diazinon and butacarb larval pressure respectively, have maintained stable 20 fold resistance factors in young larvae. Q strain achieved an adult ceiling of response 15 fold normal, under adult diazonin pressure. Subsequent larval pressure stabilized the larval resistance factor at 20 fold normal, but the adult resistance factor has declined to two fold normal. Since the resistance of field strains to diazinon is about 10 fold normal and since, moreover, the adult resistance factor in the Q strain has been shown to decline under larval pressure, the suggestion is that in the field there is adult pressure supplementing larval pressure.

Butacarb, with little contact action against adults, does not select for resistance to it in field populations of adults. The resistance factor to butacarb in adults of field strains is two fold normal.

Larval Testing—Development of a method to determine resistance factors in larvae has been a significant contribution. The method entails exposure of early instar larvae to sheep serum, plus insecticide emulsion, absorbed by rolls of paper made from cellulose. The paper is unrolled after 24 hours and counts are taken of larval mortality. LC 50 figures are calculated from these counts.

Structure-Mortality Patterns—A pattern between resistance factors and insecticide structure was sought. A commercial firm supplied experimental O.P. compounds synthesized with modifications to the diethoxy group(s). Definite patterns were found: (a) the substitution of ethoxy for methoxy groups and (b) the loss of an oxygen atom in an alkoxy group (phosphonates) gave progressive reduction in resistance factors.

Screening for Alternative Protectants—Thirty-six O.P. and carbamate insecticides were screened against early instar larvae from Q and RD strains respectively, O.P. resistance levels were 4 to 29 and fold carbamate resistance varied from 1.1 to 55 fold normal.

Field Surveillance Testing—Thirty-one field strains, obtained from stricken sheep from areas throughout New South Wales, were tested for larval resistance to O.P. and carbamate chemicals. All strains were resistant to diazinon. With 1 exception, all were also resistant to butacarb.

Semi-field Tests with Insecticides—One trial series entailed artificial implantation of susceptible and resistant larvae onto sheep previously jetted with O.P. experimental and registered insecticides. The trial confirmed that registered O.P. insecticides should give practical protection against resistant larvae. Experimental O.P. insecticides were not as effective as the standard insecticide, diazinon.

The Field Situation—A mild 1969 winter and warm, wet spring and early summer weather in the north western and central western plains favoured sheep blowflies. Serious body strike occurred, especially in the north western plains, from late September to early December, 1969. This fly wave was the first severe challenge for O.P. insecticides since the diagnosis of O.P. resistance in the Australian sheep blowfly in late 1965. Under the conditions, butacarb was ineffective in protecting sheep.

O.P. insecticides protected sheep from body strike for 4–5 weeks in all areas of the State except the north west. In country between Moree and the Queensland border this form of strike occurred within 3 to 4 weeks of jetting.

Isolated instances of failure by O.P. insecticides to protect sheep seemed to be due to inadequate jetting. Enhanced resistance levels were not found in strains of flies cultured from field-collected larvae.

DOMESTIC PESTS

Argentine Ants

For the first time since inception of the Argentine Ant Eradication Campaign, no new infestation by *Iridomyrmex humilis* was reported during the year. Thus the campaign may well be near completion. Since the initial (1950) record of this ant, 310 infestations have been found and treated—extending over 7,505 acres in Sydney, Wollongong, and Shellharbour.

This year spraying was done in 3 infestations recorded in 1968–69, and in 5 infestations found in the course of 1969–70 surveying. Some 10,438 gallons of 2 per cent chlordane was used to treat 86 acres in these 8 infestations. All known areas have now been sprayed.

The surveying this year extended to 1,765 properties; involving 41 prior infestations covering 735 acres. A few Argentine ants were found, on 8 properties in 5 infestations. A total of 296 areas, previously infested, has now been surveyed and 287 are free of Argentine ants.

BIO-ASSAY AND CULTURING

Green Peach Aphid

A colony of *Myzus persicae* was established at Rydalmere, as a reference strain to ascertain whether resistance to organophosphorus insecticides has arisen in field populations. The colony is being raised on cabbage plants, at constant 22.2°C and 40 per cent relative humidity.

Two methods to determine LD50's are being tested. In the first, a Potter tower is being used to spray cabbage leaf discs on which aphids are placed after treatment. Counts of aphid mortality are made 24 and 48 hours after spraying. In the other method, insecticides are applied to the aphids by micro-applicator; the treated aphids are placed on cabbage leaf discs, and mortality records are taken 24 and 48 hours after treatment.

Two-spotted Mite

Cultures of *T. urticae* from ornamental plants at Bathurst were established at Rydalmere, as a reference strain for resistance-tests on mites from pome fruit areas.

Australian Plague Locust

Culturing of *Chortoicetes terminifera* has progressed. Cultures were established from eggs field-collected in the autumn and locusts were reared through to the adult stage. There had been problems causing high mortalities in earlier attempts to develop laboratory cultures from material field-collected in the summer. The problems included disease and parasites as well as low vigour, and attack by an unusual parasitic mite (probably *Podapolipus* sp.). Occasional replenishment of cultures with locusts from the field has helped to promote vigour of colonies. The locust cultures are being established for bio-assay of insecticides.

Noctuidae

Mass-rearing of several important cutworms, false-loopers and bollworms has progressed; using an artificial diet comprising lima beans, agar, and brewers yeast. The species are: bogong moth *Agrotis infusa;* black cutworm *A. ipsilon;* rough bollworm *Earias huegeli;* corn ear worm *Heliothis armigera*; native budworm *H. punctigera;* green looper *Plusia chalcites*, and tobacco cluster grub *Spodoptera litura.*

Screening of insecticides against *A. ipsilon*, *H. punctigera, P. chalcites* and *S. litura* caterpillars was undertaken. The bio-assay techniques used in an attempt to develop a standard screening method included: topical application; exposure to treated filter papers or leaves of beans; and surface treatment of artificial diet, in petri dishes.

Preliminary results from bio-assay tests are:

(1) 0·1 per cent carbaryl, 0·01 per cent DDT, 0·1 per cent endosulfan and 0·01 per cent fenthion applied to artificial media at the rate of 0·5 ml of insecticidal fluid per 9 cm petri dish, were toxic to third instar *A. ipsilon* caterpillars.

(2) Petri dish tests showed that 0·01 per cent DDT and 0·01 per cent fenthion were effective against instar *H. punctigera* caterpillars; 0·4 per cent carbaryl, 0·4 per cent carbaryl + 0·1 per cent molasses and 0·1 per cent methoxychlor were ineffective against fourth instar larvae when tested in a similar manner.

(3) In tests with dipped bean leaves, 0·1 per cent DDT and 0·1 per cent methoxychlor were lethal to first instar larvae of *P. chalcites;* 1·0 per cent DDT and 1·0 per cent methoxychlor applied topically at the rate of 1 microlitre per larva were ineffective to third and fourth instar larvae of *P. chalcites.*

(4) In further petri dish tests 0·01 per cent DDT, 0·01 per cent endosulfan, 0·01 per cent fenthion, 0·1 per cent carbaryl, and 0·1 per cent methoxychlor were toxic to first instar larvae of *S. litura;* also, 0·1 per cent DDT and 0·1 per cent endosulfan were toxic to second instar larvae of *S. litura,* whilst carbaryl, fenthion, and methoxychlor were ineffective at 0·1 per cent; 0·1 per cent DDT, 0·1 per cent endosulfan, and 0·1 per cent naled were effective against third instar, and 0·1 per cent endosulfan and 0·1 per cent naled were lethal against fourth instar caterpillars of *S. litura* against which DDT at 0·1 per cent was ineffective.

Rutherglen Bug and Related Species

A culture of *Nysius vinitor* has been established in a constant temperature room (24° C and 50 per cent relative humidity). The bugs are being fed on sunflower seed and pigweed *Portulaca oleracea.* Eggs are being collected on tight swabs of cotton wool.

The culturing is aimed at development of a mass-rearing method, to provide large numbers of insects for bio-assay studies. During this work, a field observation that Rutherglen bug deposits its eggs in soil was confirmed.

Grey cluster bug *N. clevelandensis*, a related species, was similarly cultured. The bugs readily found in small numbers on flower heads of weeds (e.g. *Erigeron* sp. and *Verbena* sp.) in coastal areas in the 1969 autumn were identified as this species.

SYSTEMATIC STUDIES

The Insect Collection

This year 15,775 specimens were added. These included 4,826 Homopters incorporated into the unitary system.

Remounts were made of 1,769 insects; mostly specimens affected by verdigris or mounted on unsuitable pins.

Lepidopterous families were re-arranged according to the sequence used in "The Insects of Australia". The collection was expanded by the addition of 18 drawers. The Homoptera, up to and including some of the Coccoidea, were re-arranged according to the classification system in that book. This increased the size of the collection by 36 drawers. During this work, 1 holotype, 10 type, and 5 co-type specimens were located.

Major groups of insects returned were as follows: Thynnidae 846, Tabanidae 43, and Psyllidae 54. All were from Australian specialists. Thirty-six parcels of specimens were sent to Australian and overseas specialists.

Study of Curculionidae

A total of 1,638 specimens of weevils was added to the insect collection, making a grand total of 21,132 weevils. Specimens from the following families were added: Belidae 19, Attelabidae 7, Apionidae 7. Sub-families of Curculionidae represented were: Brachyderinae 92, Sitoninae 104, Otiorhychinae 32, Eremninae 2, Leptopinae 185, Cylindrorhininae 38, Rhytirhinae 8, Rhyparosominae 5, Diabathrariinae 2, Amycterinae 25, Gonipterinae 132, Rhadinosominae 2, Hyperinae 2, Cleoninae 13, Hylobiinae 31, Pissodinae 1, Erirhininae 403, Aterpinae 10, Amalactinae 175, Apodorinae 3, Laemosaccinae 7, Haplonychinae 31, Cryptorhynchinae 202, Rhynchophorinae 80, Cossoninae 4, Unclassified 16.

A survey of injurious and other noteworthy species incorporated into the collection was continued; 144 cards were added, making a total of 1,328 records since the survey began in 1958.

Work proceeded on the literature of taxonomy, morphology, and status of weevils; index cards were prepared. A paper and an addendum on South American weevils, established in Australia, were published.

Study of larval morphology and taxonomy of weevils, especially of *Trigonotarsus rugosus*, continued.

Mapping of the distribution of *Axionicus insignis* and *Tepperia sterculiae* was completed.

Scale Insects

Phase-contrast microscopy was used in the identification of scale insects (especially family Diaspididae; armoured scale insects) of citrus, stone, and pome fruit, and various other plants. A reference collection of permanent slides was prepared. Special attention was given to 2 armoured scale insects of citrus; red scale *Aonidiella aurantii* and yellow scale *A. citrina.*

Mites

Taxonomic studies of mites of economic importance were conducted with the aid of phase-contrast microscopy. Special attention was given to the families Tetranychidae (spider mites), Phytoptipalpidae (false spider mites), Eupodidae (earth mites), poultry mites, mites of stored products, and parasitic mites of bees and locusts. A reference collection of permanent slides was commenced.

Lepidopterous Larvae

A study of the taxonomy of lepidopterous larvae was started, with emphasis on the more important Noctuidae and Pyralidae. Setal maps, and drawings of other important identifying features, are being compiled for each species.

Chemistry Branch

CEREAL SECTION

Cereal Chemistry Conference

Three members of the Section were delegates to the Royal Australian Chemical Institute's 19th Cereal Chemistry Conference held at Toowoomba, Queensland. Dr J. Whelan, professor of Carbohydrate Chemistry at the University of Miami was guest speaker. He spoke on his speciality—enzymic methods for determination of starch structure.

Laboratory Output and Statistics

Fewer Wheat and Flour Samples.—Wheat and flour samples received totalled 2,673; 339 fewer than in the previous year. This was due mainly to fewer samples from the northern half of the State, where many Departmental trials were severely weather-damaged, and from the Grain Elevators Board—particularly the daily, running samples from premium wheat receivals.

Range of Physical and Chemical Tests.—Almost 15,000 small scale laboratory tests were done on wheat and flour samples. The range on grain samples included bushel weights, 1,000 grain weights and pearling resistances (a measure of hardness), as well as the protein and moisture tests which are done on all samples. Farinograph, Extensograph, and Amylograph tests were undertaken on 470 flour samples.

A greatly increased amount of off-grade wheat resulted from the 1969–70 harvest because of frost in September and rain at harvest time. Because of this, the Hagberg falling number test was applied to 225 flour samples. This will continue to be done for all flour samples produced in the laboratory from the 1969–70 harvest and all flour samples concerned with export certification.

Milling and Baking.—Two thousand three hundred and sixty-one test loaves were baked and assessed, and 927 units were milled in the Buhler experimental mill. The less than normal total of milled samples reflected a staff situation arising from a long illness of the Cereal Chemist.

The 1969–70 *Wheat Crop*

The 1969–70 harvest produced appreciable quantities of weather damaged wheat due to frost, and to rain damage at harvest. Production statistics are in the Division of Plant Industry section of this Report.

Five Grades Declared.—For the second successive year 5 individual grades were declared: Prime Hard, Northern Hard, Northern Weather-Damage, South-Western F.A.Q., and N.S.W. Off Grade. Unfortunately only 5·6 million bushels was received into the Prime Hard pool, and about 40 million bushels has been classed as Northern Weather-Damage. Frosts after flowering time, in large areas of the northwestern plains, were the major reason.

Frosts has several effects on grain quality. *Inter alia* it lowers the bushel weight of the grain produced, and it affects the gluten quality by causing abnormal increase in non protein nitrogen. When the grain nitrogen is calculated by the Kjeldahl method and converted to protein by multiplying by the usual factor of 5·7, the protein results may seem to be within the normal range. But if in fact there is a high proportion of non-protein nitrogen, it follows that the protein (or crude gluten) remainder has been very much reduced and thus the flour will lead to poor quality bread.

Bushel Weights and Protein Levels.—The declared bushel weights and protein contents for each of the standard grades were:—Prime Hard, 62¼ lb and 14·0 per cent; Northern Hard, 62½ lb and 12·1 per cent; Northern Weather-Damaged, 59 lb and 12·8 per cent; South Western F.A.Q., 63 lb and 11·1 per cent; Off Grade, 60 lb and 11·1 per cent.

The protein figures on a 13·5 per cent moisture basis, reflected a fall as compared to the previous season.

Protein Content, Silo Survey.—Each year a representative sample is received from each receival point in the N.S.W. Grain Elevator System. These are examined for protein content, and given other physical tests such as the bushel weight and the pearling index. Because of the number of grades determined by the Australian Wheat Board, many silos received 2 grades of wheat and at some—where storage facilities suited—3 grades were separated. The increased grading led to testing of 601 samples for the Grain Elevators Board.

The results are especially useful to the Australian Wheat Board in selecting from silos for special purposes; such as making up shipments for buyers who specify certain minimums or maximums additional to standards set for the declared grades. Thus, for example, a number of shipments of South Western F.A.Q. were sold to a South American market requiring a minimum 12 per cent protein even though the South Western F.A.Q. averaged only 11·1 per cent (on a 13·5 per cent moisture basis).

Flour Granularity Studies

Factors Affecting Granularity.—Work continued on factors affecting the flour granularity of the major wheat varieties grown in New South Wales. Such factors as season, location, and grain protein content have been studied in detail. The results show that variety is the major factor influencing granularity. Other factors exert only small influence.

In terms of flour granularity, wheat varieties fall into 2 major groups—coarse and fine. The median of the flour particle-size distribution for hard wheats is in the vicinity of 80 microns, whereas that for soft wheats is 40 microns. The percentage less than 40 microns represents the quantity of flour broken into the individual structural units of protein particles and starch granules. It too has proved a useful index of flour granularity, by giving a measure of the amenability of a variety to air classification.

The results of these studies are being prepared for publication.

The relationship between grain hardness and flour granularity is also being studied. Pearling resistance is a readily available measure of grain hardness. If a good regression equation with flour granularity is obtained this will speed up the assessment of flour granularity of plant breeders' unnamed material.

Enzymatic Determination of Starch Damage.—This year some time has been spent on setting up the new method for enzymatic determination of starch damage in flour. The method has been tentatively adopted by the American Association of Cereal Chemists and may eventually become the officially approved method. In collaboration with the Royal Australian Chemical Institute's Cereal Division Starch Damage Sub-committee, 12 flour samples with a wide range of starch damage were tested by the method. The results very closely agreed with those had by 9 other collaborators.

Now that there is a reliable and accurate method for determining starch damage, this important criterion of wheat quality may be examined more critically.

Starch Quality Investigations

Some preliminary investigations into starch quality as opposed to protein quality were made, towards evaluating some factors which may influence low protein doughs' strength and stability and their diastatic, gelation and viscosity properties. Factors being evaluated include the starch granule-size distributions, particularly of the major wheat varieties; and the alpha amylaze susceptibilities of the raw and pre-gelatinized starches of these varieties.

There has been difficulty in the use of lipid solvents to extract the starch granules from the de-proteinated flours. But the latest results indicate accurate determinations of the granule-size distributions.

Uniform Quality-Testing of Wheat

One hundred and fifty bulk samples, each about one bushel, were received for Uniform Quality-Testing (U.Q.T.). For the U.Q.T. scheme, the samples are cleaned, analyzed, and subsampled, then distributed to other participants. Four series of samples were distributed and the results of the collaborating laboratories' full cereal quality evaluations were considered at 2 meetings of the U.Q.T. Committee. This year, sets of samples were sent also to the Wheat Research Institute at Toowoomba, Queensland.

The Committee retested the crossbred TR236 (Gatcher), from the University programme, for the second year. It also did a preliminary examination of another crossbred, TR259. Mainly because of 2 previous years of testing by the Bread Research Institute, Gatcher has been recommended to the State Wheat Improvement Committee for further consideration for release. The Committee had expressed concern about possible lowering of protein levels if Gatcher were to become too high a percentage of the northwestern crop.

Crossbred 8127–266, selected from the Tamworth programme, was in its second year of testing. Because of bad weather-damage a decision on the extent to which this crossbred has overstable characteristics has not been possible. Decision has been deferred until after the 1970 harvest.

Two other crossbreds from the Tamworth programme were U.Q.T. tested for the first time and considered worthy of a further year's testing. One of these is a true winter type; the first proposed for release since Winglen and Windebri.

Two series of U.Q.T. samples were derived from the southern programmes. A crossbred M1224–2 from the Wagga-Temora breeding programme was compared with the check variety Olympic in this its second year of U.Q.T. testing. It had higher levels of protein than Olympic; also, possibly related in part to the higher protein levels, it had higher water absorption and slightly better baking quality. Conversely the crossbred gave a lower flour yield than the check variety, Olympic, but the latter for flour yield is the outstanding amongst all varieties grown in commercial quantity in Australia today. Decision on the crossbred's future has been deferred by the State Wheat Improvement Committee, pending possible further data from the 1970 crop.

The final variety considered by the U.Q.T. Committee was the Victorian variety Summit. This was compared with the check variety Pinnacle. They were similar in milling capacity. Summit was superior in baking quality. It was decided that Summit should replace Pinnacle in dryland areas only. The biscuit manufacture value of Pinnacle when grown under irrigation and producing high bushel weight, starchy, low protein wheat, is well recognized. The product is readily saleable on the domestic market. Summit does not have the desirable dough characteristics of Pinnacle and is not suitable for biscuit production.

R.A.S. Wheat Judging (Open Classes)

Most of the 112 entries in the open classes for the 1970 Royal Easter Show were from areas where the season was more favourable. These included the southern portion of the northwest slopes, and the central west. A few entries were from the north west plains and the Riverina. The Show was in mid-March. The relative earliness caused difficulties in making the results available in time.

The respective Championship winners were:

(a) *Strong Bread Wheat:*
Champion: Festiguay; grown at Jondaryan, Queensland.
Reserve Champion: Timgalen; grown at Werris Creek.

(b) *Medium Strong Bread Wheat:*
Champion: Falcon; grown at Bogan Gate.
Reserve Champion: Falcon; grown at Trundle.

(c) *Soft Bread Wheat:*
Champion: Olympic; grown at Temora.
Reserve Champion: Heron; grown at Parkes.

Grain Drying—Collaborative Studies

A study of grain-drying effects on grain hardness, milling, and general quality was started in 1969; collaborative with Dr Arnold of Wollongong University College. Some preliminary results were obtained; e.g. the effects on grain hardness as measured by grain compression. The programme has been interrupted by the departure of Dr Arnold for overseas, on sabbatical leave, but will recommence in 1970–71.

An Agricultural Engineer from Division of Research Stations, conducting a maize-drying project, sought the Section's help to determine moisture by a number of methods and to standardize a portable moisture meter. Further collaborative work with the Engineering Section is anticipated, to study the effects of drying on wheat quality, particularly at the upper limits of temperature.

Segregation of Hard Wheat in Southern Regions

The section investigated a limited segregation of hard wheat by the Grain Elevators Board in the Henty-Culcairn area. Unfortunately, because of the weather, the protein levels were lower than in previous seasons. Moreover, the pilot area chosen has traditionally been, in general, a lower protein area. Evenso, about half a million bushels of the hard variety Falcon was segregated. The desired protein levels were not attained but the wheat has been sold on the local market.

Dust in Export Wheat Shipments

In 1969 the Australian Wheat Board received complaints of unduly high levels of dust in some New South Wales wheat shipped to Amsterdam and from there transhipped to other European countries including the United Kingdom and Ireland. The first complaints concerned Prime Hard wheat. Northern F.A.Q. and South Western F.A.Q. wheat were later involved.

An investigation included examination of sampling at Sydney Terminal. Additional sampling was done in the holds of several bulk carriers. Arrangements were made for samples to be taken in a like manner when the ships reached Amsterdam. The results were compared.

Investigations to measure dust formation under controlled conditions were undertaken; also the susceptibility of individual varieties to mechanical damage, and the production of surface dust from brush hairs and the epidermis.

Denatured Wheat

A number of international trading firms discussed with the Cereal Chemist the possibility of having weather damaged wheat denatured, so that suitable bids could be placed with an Eastern country calling tenders for supply of denatured wheat.

Wheat is usually defined as denatured when it has been heated enough to make the protein unfit for bread production. The ability of the grain's proteins to adhere into the cohesive mass called gluten is destroyed. Gluten acts as the skeletal framework of a loaf of bread. Modern trade accepts wheat as being denatured if part of it is covered with a non-injurious vegetable dye which would affect bread colour if the wheat (sold for animal feed purposes) were roller-milled for flour for human consumption.

Because of apparent interest of other markets, in purchase of Australian off-grade wheat for stock feed, the Australian Wheat Board has decided to do a feasibility study on denaturing of wheat at Australian ports.

Export Certifications

Exports of wheat were continuous, from Sydney and Newcastle terminals. The purchasers of 34 shipments asked for quality certificates; 17 from Newcastle and 17 from Sydney. The requesting countries were China, Chile, Taiwan, Mozambique, Sudan, and Argentine. The certificate fee is $21.00.

Seven shipments of flour, totalling 42,389 tons, required issue of quality certificates. Revenue from this service was $283.

In June, 1970 the Cereal Chemist certified the first shipment of export sorghum from the current crop. It was exported through the port of Newcastle; an order of 15,000 tons, the first of 5 similar cargoes expected to be handled through Newcastle before receival of the 1970 wheat crop. The sorghum was going to Japan and had to be of a standard equivalent to United States Grade II yellow sorghum. It easily met the specifications and should be well received in the importing country. Dockage and allowable foreign matter were at quite low levels.

There were a number of requests for certification of oat bran for export to New Zealand in the last 3 months of the fiscal year. The bran was of acceptable quality but the Export and Import Branch had to have the manufacturer's premises examined for possible insect infestation.

Export Wheat

One hundred and thirty-seven ships, 96 from Sydney and 41 from Newcastle, carried New South Wales wheat to many countries of the world. Some shipments comprised 2 or more grades. Running samples from all ships were received in the Cereal Section, and weighted composites for each shipment were analysed. Only 13 shipments included wheat from the 1969–70 harvest. Most of the wheat was from the 1968–69 crop.

Rice Quality Testing

Work on rice quality testing was started in February, 1970. Much of the time has been devoted to tests of methods. Since amylose content of rice starch is a prime factor governing rice grain-cohesiveness and tenderness, on cooking, a fast and reliable method to determine it was needed.

The starch iodine blue test was rejected because of unreliability on samples with higher levels of amylose. Work on the photometric determination of amylose proceeded, using the method of the International Rice Research Institute. (A method testing programme is in hand collaboratively with the Institute.) This method proved time consuming.

The photometric method has been varied by using dimethylsulphoxide as a starch solvent and by de-proteinating the samples before use. By this method, amylose has been determined on the advanced breeding lines and commercial varieties, and analyses are under way on the late sown varieties in the breeding programme.

Another photometric test, using Congo red sorption to determine amylose content, is also under investigation.

Further cooking-quality tests on plant breeders' samples include: (1) use of the Amylograph to determine gelation temperature and pasting viscosity at cooling; (2) use of Farinograph to determine the maximum water absorption of rice on cooking; (3) protein content. These tests have been done on all commercial and advanced breeding lines, together with Amylographs on a waxy rice variety from the breeding programme.

Starch granules have been separated from 2 of the commercial varieties and work is proceeding to see if cooking differences can be explained by the mean granule size or the size distribution of the starch.

PESTICIDES SECTION

Residues Analysts' Conference

Three members of this Section presented papers at a Residues Analysts' Conference, held in Sydney, organized by the Commonwealth Department of Primary Industry. Representatives from various State Departments, research organizations, and the chemical industry attended.

Chlorinated Pesticide Residues in Eggs

The N.S.W. Egg Marketing Board's detection of pesticide residues in eggs led to an increased number of investigations. Samples of eggs and feed components collected by field officers from offending producers were analyzed for hexachlorobenzene (HCB), DDT and other pesticides.

Sometimes high levels of HCB were detected in eggs, but the feeds examined contained only very low levels of that compound. DDT contamination usually was the result of poultry having access to areas treated with DDT. In a few instances, feed containing high levels of DDT was associated with egg contamination. In one case high lindane levels were detected in hens which had been treated with lindane to control pests.

Mercury Residues in Poultry

An experiment was conducted at Glenfield Veterinary Research Station wherein hens were fed for 7 weeks on wheat treated with 2 commonly used organomercury fungicides, phenylmercury acetate (PMA) and methoxyethylmercurychloride (MEMC), in concentrations of 10 ppm Hg and 20 ppm Hg.

Highest levels of mercury residue found during the trial were: 6 ppm in egg yolk, 0·09 ppm in egg white, 10 ppm in liver, 46 ppm in kidney and 0·43 ppm in breast muscle. After normal feeding was resumed, no mercury remained in the eggs and only traces in the liver and kidney tissues after 4 weeks.

This trial demonstrated that the feeding of mercury-treated grain leads to appreciable quantities of mercury residues in eggs and other tissues, and could be a health hazard.

The extent of contamination of commercial eggs and stock feeds by mercury residues will be surveyed.

Pesticide Residues in Beef Cattle and Sheep from Cottonseed

The beef cattle and sheep feeding trials at Trangie and Temora Agricultural Research Stations have been completed. Beef cattle, fed for 6 months on 10–20 per cent cottonseed meal containing low levels of DDT, did not seriously accumulate DDT in the fat. Sheep, fed for 13 months on diets containing whole cottonseed and cottonseed meal, likewise showed no increased residues in their fat.

These results confirm findings with other species, that a residues hazard will not arise when cottonseed products as above are fed to stock.

DDT Residues in Rice and Sheep

Several investigations have been conducted on rice after various DDT treatments, notably irrigation water treatments and aerial application to maturing rice crops, were applied for control of pests.

Negligible residues resulted from the water treatments, but aerial spraying produced residues up to 20 ppm in paddy rice. Dehusking of the sprayed rice reduced residues by more than 90 per cent to bring the grain well within Australian tolerances. DDT content of the husks was however up to 8 times that of the original paddy rice. Thus there would be a residues hazard if contaminated husks were included in stock feeds or used as poultry litter. Such use of rice hulls is being officially discouraged.

Grazing of rice stubble by sheep after the harvest is common practice. A grazing trial was conducted with stubble where the rice had been aerially sprayed with DDT. After 6 weeks grazing, average subcutaneous fat residues increased 5-fold over those present before grazing. These residues were still within F.D.A. tolerances, but there could have been excessive residues if rice residues had been higher and the animals restricted solely to the rice diet.

Hexachlorobenzene Residues in Wheat and Wheat Products

Because of hexachlorobenzene residues in commercial wheat, the source of contamination was sought.

Glasshouse trials indicated no significant uptake of hexachlorobenzene into harvested grain grown from seed wheat containing normal treatments of hexachlorobenzene. This indicated probable contamination of commercial grain by external treatments; probably by way of admixture of treated seed with harvested grain. Because of drought, a large quantity of treated seed has not been sown, and this may in part find its way into commercial grain.

In collaboration with the Cereals Section, the contamination of milled products derived from grain treated at the 0·05 ppm level, or a 6,000-fold reduction of the normal wheat treatment, was assessed. Bran and pollard contained some 80 per cent of the initial residue. This could be enough to cause problems in stock food. When the flour was converted into bread there were still low residues of hexachlorobenzene. Results of this work were included in a successful submission by the Commonwealth Department of Primary Industry to an FAO Working Party of Experts in Rome in December, 1969; recommending temporary practical residue-limits in cereal products.

Benomyl Residues in Fruit

Experiments have been conducted with the Biology Branch to determine in fresh and canned fruits the residue levels of benomyl, a very effective systemic fungicide for control of fruit rots.

Residues in cherries treated with sprays containing from 0·01 per cent to 0·1 per cent benomyl at 8, 6, and 2 weeks prior to harvest, ranged from 0·48 to 3·3 ppm in the flesh. Cherries treated post-harvest in 0·004 per cent or 0·016 per cent dips had residues of 0·67 and 2·1 ppm respectively.

Apricots sprayed with 0·025 per cent benomyl 7 days pre-harvest had residues of 3·7 ppm in the flesh of fresh fruit, and 1·1 ppm after canning. Apricots sprayed with 0·1 per cent benomyl 7 days pre-harvest had residues of 3·4 ppm after canning; fruit sprayed with 0·025 per cent benomyl 26 or 29 days pre-harvest had residues of 0·65 and 0·90 ppm, respectively, after canning. Benomyl was not detected in canned fruit after a soil treatment or a 0·025 per cent spray 4 months pre-harvest The juice of canned fruit contained about 5 per cent of the residue found in the fruit itself.

Benomyl was not detected ($< 0{\cdot}1$ ppm) in fresh apples treated with 6 sprays of 2 to 4 oz a.i./100 gal applied between 6 and 4 months pre-harvest.

No official Australian tolerances have so far been recommended for benomyl in fruit.

Dimethoate and Thiabendazole Residues in Bananas

Further experiments involving post-harvest dipping of banana fruit for fruit fly and disease control were conducted at Gosford Citrus Wastage Research Laboratory, to investigate dimethoate and thiabendazole residue levels in the green and ripe fruit.

Fruit were dipped in various concentrations of mixed dimethoate and TBZ for 30 seconds. Dips containing 0·03 per cent and 0·05 per cent dimethoate led to residues of 0·53 ppm to 0·89 ppm dimethoate; dips containing 0·02 per cent and 0·1 per cent TBZ led to residues of 0·26 ppm to 3·3 ppm TBZ in the green fruit. Over one-third of the dimethoate residue was lost after 1 week ripening but there was little loss of TBZ. Only trace residues were present in the pulp.

The Australian tolerances for dimethoate and TBZ on the whole fruit are 2 ppm and 3 ppm respectively. The tolerance for TBZ in the pulp is 0·4 ppm. Further experiments, involving mixed dips and using a commercial dipping procedure, will assess residues likely under commercial conditions.

Thiabendazole Fruit Dips

TBZ dipping of bananas was continued, to complete investigations of the efficacy of dips to control post-harvest diseases. The results formed the basis for recommendation of 200 ppm dips being used under the Plant Diseases Act. Examination of 1,000 ppm dips revealed risk of exceeding the 2 ppm tolerance set by National Health and Medical Research Council.

Work with TBZ on citrus showed the need for alterations to the common form of fruit treatment plants to utilize the TBZ effectively. A 1,000 ppm dip was found to be optimal.

New analytical methods for TBZ have been developed, suitable for both laboratory and field use.

Investigations were conducted with mixed dips containing thiabendazole and dimethoate. Dimethoate dips are a quarantine requirement, for banana fruit entering the Murrumbidgee Irrigation Areas, to prevent entry of the Queensland fruit fly. Rates of stripping and topping-up requirements were measured under commercial conditions.

Work to pinpoint the cause of some isolated cases of TBZ breakdown during extended use is continuing.

Herbicide Residues

Samples from a 5 year crop-rotation trial at Yanco are being analyzed, to estimate possible danger associated with use of persistent herbicides for one crop of a tight crop-rotation. Development of a method using infra-red spectroscopy has allowed the handling of 8 times as many samples as the conventional residue-analysis method.

Survey of Pesticide Residues in a Cotton Area

Assessment of possible hazards to wildlife through repeated DDT applications to control cotton pests is proceeding in the Namoi district.

Sampling in co-operation with officers of the National Parks and Wildlife Service and the Fisheries Branch of the Chief Secretary's Department has coincided with the 1969–70 cotton spraying programme.

Samples of water, sediment, algae, fish, crayfish, and ducks have been analyzed for pesticide residues. DDT has been detected in all; ranging from trace amounts in water to several ppm in bird fat.

Dieldrin in Wildlife (The Seed-harvesting Ant Problem)

A preliminary survey is in hand, to evaluate possible hazards to wildlife through coating pasture seeds with dieldrin to reduce losses caused by seed-harvesting ants.

Early experimental work with dieldrin treatment of aerial sown seeds was done in the Bathurst district. The dieldrin treatment has continued. Therefore a survey of bird life there was undertaken in co-operation with officers of the National Parks and Wildlife Service. The survey coincided with the period of seed application (late autumn-early winter). In samples of bird fat so far collected, dieldrin as well as DDT has been detected.

Maldison Residues in Stored Grain

In co-operation with Entomology Branch, the effect of aeration techniques on maldison residues and weevil control in stored wheat is being studied. Preliminary results suggest that initial aeration of the stored grain may significantly reduce losses of maldison, apparently by lowering grain temperature.

WATERS, REGULATORY AND GENERAL SECTION

Conferences, Field Days, and Lectures, etc.

Arid Zone Research Conference.—Personnel of the Waters Section attended the 3rd Australian Arid Zone Research Conference held at Broken Hill in May, 1970. They contributed papers and discussed Arid Zone management problems.

Field Days and Lectures.—Personnel of the Section delivered talks on and conducted irrigation experiments or demonstrations at field days at Casino, Hawkesbury Agricultural College, and Galston. Accent in some cases was on trickle irrigation techniques and their effectiveness.

Australian Water and Waste Water Association.—The Chemist in charge of the Waters Section addressed, by invitation, this Association in Melbourne; on salinity problems in agriculture with particular reference to areas served by the Murray River System.

Water Analysis

This service had continued support from graziers, pastoralists, small farmers, and industry associated with primary production, but volume of enquiry was lower than in previous years. The trend could alter shortly, because drought conditions are now again being experienced along the mid and north coast and in the northwest.

The decentralized Regional Water Testing Services accounted for 1,807 samples, whilst analyses and reports on 396 were done by headquarters, at Rydalmere.

In Mid Coast and Hunter Region, where 434 samples of water were tested, a feature was the large number of samples arising from proposed vineyard irrigation schemes. Many of these showed high total salts, residual alkali and chloride. Since in most cases the proposed use was only as small supplements, the interpretations as to suitability of the samples were faily liberal.

"Problem" Waters and Pollution

Demand has increased from the Water Conservation and Irrigation Commission and from private landholders, for detection and advice on pollution of watercourses from commercial and rural operations.

The Department of Agriculture does not have an action role in the amelioration of stream pollution, but its analytical services and advice relative to effects of pollutants on crops and stock are authoritative.

Soil Moisture Research

The Chemistry Branch has over the years successfully developed a solid-state portable meter. This has found wide acceptance within Australia for use by farmers, graziers, and public authorities, to assess water and soil salinity.

Further exploitation of the meter's potential in respect of irrigation has been achieved by development of a capacitance-type soil moisture tension-sensor with a range of zero to 4·2 pF. The sensor has found a degree of acceptance by research personnel and irrigationists for assessment of soil moisture status in root zones.

Repeat sales of the meters and sensors have occurred in a number of overseas countries.

Research this year has been aligned to calibration of the soil-moisture sensors within the range zero to 2·7 pF, using a sand bed suction-table, constructed within the Chemistry Branch. This is similar in design to those at the Institute for Land and Water Management Research at Wageningen, The Netherlands. There they are extensively used to study the soil-moisture retention characteristics of a large number of soil cores simultaneously, over a range of zero to 2·7 pF. They require little attention. The model constructed here at Rydalmere does not employ a vacuum pump. Suction is applied throughout the range by a static, hanging column of water.

Observations so far reveal a remarkable degree of correlation between individual sensors and meter readings of soils of different textures at equivalent pF equilibrium of the sand bed.

Stock Feeds and Medicines

Appointment of an experienced graduate chemist enabled restoration of regulatory analyses under the provisions of the Stock Foods and Medicines Act. Systematic quality-surveys of registered products have been re-introduced. These included sampling of dairy feeds from the mid-north coast, a range of stock feeds from Wagga district, and protein concentrates from a variety of sources.

Several instances of non-compliance with guaranteed analyses were reported and appropriate Departmental action was taken against offenders. Such cases were followed by further samplings to ensure that products offered for sale were in accordance with the guarantees.

Other samples required, in specific cases, specialized attention because of complexity of analyses. Some that involved investigation of methods were gossypol in cottonseed; cresols in meat meal; hexachlorophene in soap; and urea and biuret in a stock lick, complicated by high molasses content of the produce.

Margarine

Cooking margarines from all manufacturers were checked for compliance with the Act, in respect of fat composition. Bulk margarines offered for sale to the public received particular attention. Most cooking margarines contained the legal minimum of 90 per cent animal fat, with the remaining 10 per cent predominantly one of the polyunsaturated vegetable oils such as safflower. Coconut oil in smaller quantities was in some.

Diacetyl and acetoin determinations on certain cooking margarines showed levels of these flavour components that were within the range expected in butter. Their presence is because of the use of starter cultures in the manufacturing; giving the margarine a butter-like flavour.

Dairy Products

Milk powder samples were examined for adulteration with other edible animal and vegetable oils, following a dairy factory's use of spray-drying equipment to manufacture cake mixes and similar products. The presence of small quantities of fats other than butterfat pointed to need of more thorough washing of lines and plant between runs.

Chemical composition of one of the recently introduced "spreadable butters" was found to be within the range of normal butter. No fractionation of the butterfat, nor admixture with soft vegetable oils or other additives, was detected. Any improvement in spreadability was seemingly due to improved physical structure brought about by the particular manufacturing techniques.

Other dairy products examined included a sample of North African ghee, and an imported Continental soft cheese suspected of containing "filled" fats. Whilst there were some marked differences in composition, as expected of foreign butterfat compared with the local product, there was no indication of adulteration with other fats or oils. The product was therefore considered to be genuine.

Stockfeeds Classification System

Following a proposal by the Standing Committee on Agriculture to introduce a uniform national system of feedstuffs classification, an officer of the Chemistry Branch took part in discussions with Commonwealth and State Chemists, animal nutrition research workers and specialists from industry. This related to standardization of analytical procedure and the methods of reporting and collating data. The system, based on that currently operating in North America, is designed to record both analytical and animal response data.

State Departments of Agriculture have provided lists of laboratories and research institutes throughout Australia likely to co-operate in the venture by contributing information to be processed and published by the Animal Feedstuffs Collating Centre in Canberra.

Selenium in Animal and Plant Nutrition; Research

Research into the biological and chemical aspects of organoselenium compounds is being undertaken by an officer in connection with his post-graduate studies at the University of New South Wales.

The research is seeking an understanding of the uptake and distribution of selenium in its different forms in the plant and animal, leading to an examination of the biological roles played by these sources. Close attention will be given to analytical procedures for the estimation in biological materials not only of total selenium but of its different forms.

Drought Feeding of Sheep; Research

Analytical work has been undertaken in connection with a Sheep Drought Feeding Experiment in hand at the Wool Research Laboratory, Trangie Agricultural Research Station. Over 1,000 samples are involved. These include feed, faeces, urine, and blood. The variety of analyses will provide nitrogen balance data. The blood and urinary urea determinations involve a new auto-analyzer technique.

Ruminant Nutrition Research

Preparatory studies have been undertaken and initial samples are being examined by gas chromatography to determine the volatile fatty acid content of rumen liquor. The data obtained should help to explain production differences between various animals grazing different pastures, in a Ruminant Nutrition Experiment in hand at the Wollongbar Agricultural Research Station.

PHYSICAL CHEMISTRY SECTION

X-ray Analysis

The simultaneous automatic X-ray fluorescence spectrometer ordered during the previous fiscal year and shipped from Holland is now installed at Rydalmere.

Applications studies have shown a significant improvement of results if the intensities measured by the spectrometer are processed by computer. More complicated formulae can be applied than with the data processor originally supplied.

Modifications to the instrument are being made to present results in a form suitable for feeding directly into the computer. The computer will then calculate and print out the concentration figures required. The parameters necessary for programming the computer are now being determined.

Spectroscopy

A spectrofluorometer was acquired for analysis of aluminium in soil and plants. This fluorometric technique is very much more sensitive than the atomic absorption spectrophotometric method. Sensitivity of the former is about 0·005 μg/ml and of the latter 1 μg/ml.

The new technique is also superior to the colorimetric method because of the absence of interference by other elements. Interference is fairly extensive in the colorimetric method.

The fluorometric technique has many other applications in both inorganic and organic chemistry. For example: selenium, vitamins, and amino acids, etc., can be analyzed by fluorometric techniques.

The autoanalyzer is now in full use for phosphorus analysis in plants. The digestion solution prepared for atomic absorption spectrophotometry can be used directly on the autoanalyzer. Absence of reliable heating facilities has made it difficult to obtain agreement in the nitrogen determinations as against the manjal Kjeldahl method. It is hoped to rectify this situation in the near future.

The atomic absorption spectrophotometer continued to play a very important role in soil and plant analysis for calcium, magnesium, sodium, potassium, copper, zinc, iron, manganese. Some 5,000 soil extracts and plant samples were analyzed during the year. A feature of the soil extract analysis for calcium, sodium, potassium, and magnesium has been the ability to read directly in concentration (milliequivalents per cent) in the sample; thus saving a good deal of calculation time—as only moisture corrections now require calculation by the staff.

Two additional methods are to be investigated in the coming year, namely cobalt in soil extracts, and sulphur in plant material; both being determined on the atomic absorption spectrophotometer. In addition, some urea nitrogen analyses on the autoanalyzer will be done in collaboration with Trangie Agricultural Research Station.

PLANT NUTRITION SECTION

Samples Analyzed 1969–1970

Both the range and total of analyses showed a marked increase over previous years. Determinations done on the atomic absorption spectrometer comprised potassium, calcium, magnesium, sodium, manganese, zinc, copper, and iron. Some of the other analyses were for nitrogen, phosphorus, boron, chloride, molybdenum, sodium, sulphur, pH, bromine, nitrates, ignition loss, neutralizing value, calcium and magnesium in limes and gypsums. The total of analyses was 35,249; samples from research trials and surveys, and samples for diagnostic purposes. The samples for diagnostic purposes included many submitted by growers through field officers. The aim of the diagnostic work was to report as quickly as possible to the grower, to enable timely remedial action.

To assist field recognition of symptoms a colour-illustrated book on common mineral deficiencies in pastures, vegetables, and fodder crops has been prepared. It is likely to be off the press in the ensuing year.

The diagnostic service now includes nitrate analysis to predict nitrogen needs of cotton; also to measure toxic levels of nitrate in a range of crops. Tests for aluminium toxicity have also been introduced.

In effect, information can now be provided on any likely mineral deficiency or toxicity of any crop grown in New South Wales.

Zinc Investigations in Relation to Maize

Glasshouse trials are continuing. Also, further field trials have been sown. The glasshouse trials in the winter gave further leads for use in the summer field trials. Main lines of investigation have been varietal susceptibilities, and the placement, rate and form of zinc.

Varietal Susceptibility.—Thirty-six strains of maize are in a screening trial. Commercial hybrids as well as breeding material comprising single crosses and inbred parents are included. The trial has revealed big differences in varietal susceptibility of maize grown in zinc deficient black soils from the Gunnedah area.

Some varieties have shown spectacular zinc deficiency symptoms. In others the patterns were less distinct although many of these gave good zinc response in growth. Zinc uptake and distribution within the plant are being evaluated.

On the basis of growth response and symptoms, several varieties seem relatively tolerant of zinc deficiency, others intermediate in response, and others very severely affected. Many of the early N.E.H., D.S., and Pioneer Queensland varieties which are those most common in the Gunnedah-Quirindi area, seem very sensitive to the zinc problem; generally more so than later coastal varieties. The investigations are continuing.

District, maize variety trials conducted by Division of Plant Industry, and commercial crops, show that zinc deficiency is not confined to the "black soils" of the northwest. Symptoms have also occurred in crops on other soil types that are widely distributed through the State. Chemical analyses have supported the diagnoses made on leaf symptoms.

Many crops other than maize have been found to be seriously affected by zinc deficiency when grown on alkaline soils of the northwest.

Ratings of the severity of leaf symptoms in the 1969–70 variety trial at Leeton indicated marked intervarietal differences.

Zinc Forms and Placement.—Effective treatment for zinc deficiency of maize has been established as dusting the seed with zinc oxide then one or more zinc sulphate sprays for the growing crop. Possible long-term correction with heavy dressings of zinc sulphate (up to and over 1 cwt per acre) is also under attention.

Pot trials this year compared rates and placement of both zinc sulphate and zinc oxide. Equivalents of rates up to 100 lb/acre were applied. So far, band placement has seemed inferior to complete or partial mixing through the soil, and this was unexpected in view of the known capacity of the soil to fix zinc.

Zinc oxide is superior to zinc sulphate; pound for pound. The former is about twice the price but has more than three times the zinc content of zinc sulphate heptahydrate. Further evaluation on an equivalent zinc basis will be done. This current pot-work will be followed-up in the field.

Zinc sulphate monohydrate in pelleted form with nearly twice the zinc content of the heptahydrate form has become available. It also is being tested.

Zinc Stored in Maize Grain.—Chemical analysis of individual seeds of maize (hybrid NEH–1151) from a particular crop showed that the quantity of zinc stored in the seed was a linear function of seed weight (the heavier a seed the greater its zinc content). Because seed-stored molybdenum is known to be important in the establishment of maize on soils low in molybdenum-availability, an experiment was done to determine whether there is an analagous situation in the case of zinc.

The experiment proved that the quantity of seed-stored zinc is important to seedling growth when seeds are sown in zinc-deficient soil. In the three weeks after emergence, the growth of plants from small seeds (low zinc content) was severely restricted, whilst growth of plants from large seeds (high zinc content) was normal.

Maize growers currently purchase the smallest seed obtainable, to increase the sowing-efficiency and reduce seed cost. But on zinc-deficient land this practice may cause early onset of zinc deficiency. The risk could possibly be avoided by using large seeds, or by dusting the seed with zinc oxide.

Procedures which should increase the amount of seed-stored zinc are being investigated.

Effects of Soil Aeration.—Excessive watering of the cracking, black Quirindi type of clay soils can cause poor aeration. Zinc deficiency of maize grown on these soils, in the field and in the glasshouse, has frequently been observed under conditions where aeration was limited.

Zinc deficiency under field conditions often follows excessive watering. Waterlogging is known to cause chemical changes in the soil and affect metabolic processes in the root.

Zinc Deficiency in Cotton

In the Namoi Valley the major fertilizer used for cotton has been nitrogen. In trials there has been no definite response to phosphorus, potassium, or the micronutrients manganese, boron, copper, and iron. Small localized areas of an apparent nutritional deficiency have been noted in the past; areas that appear to recover later in the growing season but still yield less than the unaffected areas. Zinc deficiency was suspected.

Affected plants were light green even though well supplied with nitrogen; shorter than normal, and very uneven in height. In more severe cases there was interveinal chlorosis, particularly in the older leaves. These leaves were generally smaller and thicker. Brown patches sometimes developed within the chlorotic tissue. Lower leaves were shed, leaving 3 or 4 small leaves at the apex. Affected plants developed leaves slowly. Length of stem between each successive leaf was drastically less than normal.

In plots receiving zinc sulphate, the plants grow better, are greener within 7 days of foliar zinc spray application, show a doubling of the number of bolls and increased retention of them, plant height increases, through longer internodes, and leaf symptoms are completely removed.

Molybdenum Deficiency in Wheat

Molybdenum deficiency occurs in a wide range of plants in this State. Pasture legumes, cauliflowers, rockmelons, lettuce, and tomatoes are often affected. Occurrences in grasses and cereals are unusual but maize seedlings readily show the deficiency if grown (in deficient soil) from seed which has a low molybdenum-status.

Wheat has shown deficiency symptoms in pot trials using a soil known to be deficient in molybdenum. The symptoms are far less distinct than in maize or in many other crops and if seen in the field could easily be discounted as due to other causes.

Indications of wheat responding in the field were first observed by Dubbo District Agronomist, Mr L. Meakins last year. There was colour difference between 2 parts of a wheat crop; part of the crop showing deeper green colour had been sown with molybdenized superphosphate, and the pale section with plain superphosphate. Leaf and grain analyses in due course showed increased molybdenum content in the darker green section of the crop.

Molybdenum deficiency symptoms were most severe and showed up first in wheat (grown from seed harvested from the deficient country) that received no molybdenum in the pot but was given nitrate fertilizer. Symptoms were first observed at the 2 to 3 leaf stage 10 days after emergence. Nitrate levels in the seedlings at this stage were higher in treatments not receiving molybdenum; suggesting incipient molybdenum deficiency in all these treatments.

Acid Soils, Pasture Species and Lime

Numerous investigations of acid soil infertility have been made. These followed observations of inferior plant growth on acid soils, plant responses to lime application, or the ability of certain species to grow normally where others fail.

In a previous study (pot experiments) of the infertility of a number of southern tableland acid soils it was found that on some of these soils lucerne and phalaris (but not subterranean clover, perennial ryegrass, or white clover) were affected by aluminium toxicity. Lucerne was also affected by manganese toxicity on some soils, whilst subterranean clover resisted the effects of the high manganese supply.

A further project has now been started at Rydalmere, to study acid-soil infertility problems of pastures.

It is generally accepted that, apart from the nodulation of legumes, which is affected by pH *per se*, increasing acidity over the range from pH 7·0 to pH 4·0 does not greatly inhibit plant growth. Thus: factors associated with soil acidity, rather than the hydrogen ion concentration itself, cause the severe abnormalities of plant growth observed on some acid soils.

Both aluminium and manganese compounds become more available to plants as the soil pH falls. A number of overseas authors have suggested that these aluminium and manganese toxicities are the most common causes of acid soil infertility. However, other factors causing such infertility are: the insolubility of phosphorus and molybdenum, and the absolute deficiencies of base cations (e.g. calcium, magnesium, and potassium) and of acid-soluble trace elements (e.g. boron, zinc, and copper). Toxicity of nickel and high rates of denitrification have also been reported in acid soils.

In this project's initial pot experiments, subterranean clover and lucerne have been grown on 32 acid soils collected from the slopes, tablelands, and coastal districts. The soils were selected where pasture establishment failure or poor productivity was thought to be caused by the low soil pH or associated factors.

Subterranean clover responded to lime on 10 of the soils, and lucerne to 20. The responses were not due to the alleviation of calcium, sulphur, or nitrogen deficiencies. These nutrients had been applied at adequate rates in all pots. Liming eliminated manganese-toxicity symptoms in lucerne on 7 of the soils.

Lucerne appeared to show aluminium toxicity on 18 of the soils. In some cases, symptoms of both toxicities occurred together. Subterranean clover developed manganese-toxicity symptoms on 2 soils. Also, it responded to lime on soils where lucerne was very severely retarded by aluminium toxicity, but it did not develop clear toxicity symptoms.

Further work is to be done, in the field and the laboratory; on susceptibility of different species and strains of pasture grasses and legumes to specific acid soil problems, and to find the best methods of countering harmful effects of the various factors in the soil-acidity complex.

Sulphur Availability from Sulphur Fertilizers

Next to nitrogen and phosphorus, sulphur is the most important major-element deficiency of pastures in this State's higher rainfall pasture areas. For many years phosphorus and sulphur needs have been met almost entirely by superphosphate.

In recent years the awareness of the differing needs of phosphorus and sulphur for different soils, climatic regions and stage of pasture development has stimulated the development of a wide range of commercial sulphur and phosphorus fertilizers. These have various S:P ratios and availability patterns. In effect, problems have been posed by the wide range of materials offering.

Availability of sulphate and of elemental sulphur forms in sulphur-fortified superphosphates (S.F. 30 and S.F. 50) have been studied from the time these fertilizers were first manufactured in this State. The 3 different methods of manufacture used have produced characteristically different particle-size distribution patterns in the elemental sulphur fraction. In consequence, there have been different availability-patterns when applied to pastures. Gypsum and elemental sulphur forms have been compared, especially for the effect of particle-size on their availabilities.

Nitrate Investigations

Nitrate Electrode Methods.—Nitrate electrode methods for nitrate analysis have been devised and are now in use in the Branch. Two papers on nitrate analysis of plants in soils and waters have have been submitted to *The Analyst* for publication in 1970.

Nitrate Testing.—A knowledge of plant nitrate content is helpful to: evaluate the nitrogen status of certain crops; predict nitrogen fertilizer needs (when soil nitrate levels are known); and to indicate forage toxicity.

Cotton, adequately irrigated, has been found to have petiole nitrate levels which vary seasonally between 30,000 and 100 p.p.m. nitrogen (as nitrate) on a dry weight basis.

Young cereal crops grown under high rates of nitrogen or favourable climatic conditions, or both, can accumulate more than 10,000 p.p.m. nitrogen (as nitrate). Fodder nitrates of this order can poison grazing stock.

The nitrate concentration of drinking water and foods is a problem in both human and animal nutrition, since large amounts are toxic. A correlation between nitrogen fertilizer use, the nitrate content of canned foods, and corrosion of the can body was reported recently.

A quick method to measure nitrate levels has been needed. One of the plant nutrition chemists has evolved, from 2 years study of new methods of nitrate analysis, a method that measures nitrate concentration on solution; as a function of the potential difference between a nitrate-sensitive electrode and a reference electrode. Nitrate contents of plant and soil extracts and of low salinity water samples have been accurately determined by it.

The method is much faster than other nitrate tests, because the nitrate content is determined directly on extracts or water samples by an operation analogous to a pH measurement.

With this method, 3,000 plants were analysed for nitrate this year. These were mostly connon petiole samples from Division of Plant Industry nitrogen fertilizer experiments in the Namoi area.

Some analyses were done on oats from "variety x N x seed rate" experiments.

Brominated Chemicals in Mushroom Cultivation

Yields of the cultivated mushroom *Agaricus bisporus* are affected by parasitic and competitive micro-organisms including fungi, bacteria, actinomycetes, and viruses. Most commonly the control is by peak-heating and cooking-out with live steam. But use of chemicals is increasing.

Two factors limit the number of usable chemicals. Firstly, mushrooms are open-textured and porous and readily absorb chemicals. Secondly, the short interval between application and harvest allows little breakdown of chemical residues.

Two bromine chemicals are now used; methyl bromide, and a mixture containing potassium bromide and sodium hypochlorite. Good penetration, plus high toxicity to parasites, makes methyl bromide an excellent fumigant except for the risk that high levels of bromine may be taken up by the growing mushrooms.

The potassium bromide/sodium hypochlorite mixture effectively controls certain species of bacteria by releasing bromine when dissolved in water.

Uptake and tolerance-limits of bromine in mushrooms as affected by concentration of bromine in the application, and temperature, atmospheric pressure, and humidity, are being studied.

Granulated Slag as a Liming Material

Phosphate content of granulated slag from blast furnaces as produced in Australia is low compared to the basic slag from some smelters in Europe. The local slag contains a good deal of calcium and some magnesium as silicates (equivalent to 64% $CaCO_3$; + 3·4% $MgCO_3$;). At present the material is dumped. But work is in hand to determine whether it has potential for liming acid soils.

Granulated slag of several degrees of fineness was compared with finely ground agricultural lime; for pH changes and lucerne growth in an acid soil. Treatments were: agricultural lime, slag ground to pass 100 mesh sieve, slag passing 18 mesh sieve, and granulated (not ground); each at 10, 20, 40, and 80 cwt per acre.

Analyses of lime and slag samples had shown that slag had about two-thirds the total calcium and magnesium carbonate equivalents found in the agricultural limestone. Thus, slag might be expected to approximate two-thirds the effectiveness of agricultural lime.

In terms of soil pH and of lucerne growth, agricultural lime was found to be superior to slag in any of the forms used. Grinding slag to pass a 100 mesh sieve did markedly improve its effectiveness, but granulated slag and slag passing the 18 mesh sieve were poor performers even at high rates of application. Fine slag, passing the 100 mesh sieve, was 50 to 60 per cent as effective as agricultural lime in terms of lucerne yield. From the soil pH curves, slag is about 30 per cent as effective as agricultural lime.

The results of this work are preliminary but it is already apparent that slag will only give results comparable with those of agricultural lime if it is finely ground.

CITRUS NUTRITION WORK

The Survey.—A citrus survey has been completed in the State's four main citrus areas. Reports on the M.I.A. and the Dareton citrus surveys have been completed and presented at two field days. The results of these surveys have also been supplied to a number of fertilizer firms. The fertilizer firms have shown their interest by establishing or intention to establish a service for the growers in those areas.

The citrus nutrition research and this recent survey have in no small way helped the firms' services. Standards and methods used by the companies concerned are largely based on the departmental results.

Citrus Deficiency and Toxicity Problems.—A new trial is to be established on young lemon trees, relative to magnesium deficiency and manganese toxicities. This, being aimed to provide more information on standards and critical levels of nutrients, will continue the previous research on citrus.

Industry and other laboratories are constantly seeking research information relative to local conditions, as a guide to analytical programmes.

Peat Soils and Added Chemicals

The area of peat soils in this State is small, but an area near Berry has aroused economic interest because of its convenient location and its extent. It extends in scattered areas from Berry to 5 miles south of Nowra.

Field work, by the District Research Agronomist, has shown a need of heavy lime dressing in the field.

Glasshouse work in the 1968 spring and the 1968–69 summer has indicated that on white clover these dressings are not needed; that the prime deficiency is sulphur, with slight deficiencies of phosphorous and boron. In contrast, subclover in the glasshouse work has responded well to lime at a number of levels and, on one soil, established plants of *Lotus major* have shown a slight benefit from liming. On a second soil no *Lotus major* plants could be established without liming.

Chemical analyses showed all 13 soils tested with white clover to be supporting plant growth high in sodium, but adequate in K, Ca, Mg, Mn, Cu, Zn, and B.

Manganese Toxicity in Lucerne

A paper ("Influence of manganese toxicity on lucerne growing in the Albury area") was accepted for inclusion in the handbook for the Australian Plant Nutrition Conference, 1970.

SOILS SECTION

Overseas Study

Early this year an overseas visit to study soil analysis and related subjects was undertaken by Soils Chemist Mr I. Vimpany. A clearer understanding of the reasons behind the shortcomings of conventional soil testing procedures for potassium in New South Wales is one outcome.

Field Trials and Soil Testing

Soil and plant analyses from trials continued. A number of trials ended and the writing-up of results is proceeding.

Trials involving a new design and a new approach to soil testing were laid down at a number of centres. Preparations were also made for a new, field trials project financed from Wool Research Trust Funds.

Collection of undisturbed cores, and the testing of these for comparison with field plots following provision of complete equipment have started.

X-Ray Equipment

Diffraction.—The equipment was commissioned this year and a number of soils from the Central West Wheat Research Project have been examined.

Spectrography.—Following commissioning of the equipment, much time has been devoted to calibration. This involved initial attempts by Phillips Electrical Pty Ltd, under their contract, and subsequent work by the Chemistry Branch.

Soil Testing for Phosphorus

Wheat.—Three hundred and fifty soil and 2,500 grain samples from the Central West Wheat Research Project were analysed for phosphorus. The wheat fertilizer trials involve a factorial design; four rates of superphosphate and four rates of sulphate of ammonia.

Eight different soil phosphorus tests were used on each sample. No one method appears outstanding for all soil types. The correlations between soil phosphorus test levels and crop resistance to superphosphate applications are weak, accounting for less than 50 per cent of the variation in response. The correlations are especially poor for experiments in the lower rainfall areas (16–18 inch average annual) of the central west wheat belt centred around Trangie and Condobolin.

Inclusion of a measure of the climate variable in the prediction equation should improve the correlation. Some trials are now being instrumented as completely as possible to measure the soil and micrometeorological factors influencing response.

Pastures.—This year seven pasture fertilizer trials have been established in the Berry-Nowra-Moss Vale area. The experiments involve 4 initial rates of superphosphate followed by 4 rates of annual maintenance dressings, in a factorial design.

The aims are to find: (1) the optimum economic soil test level (the soil test level beyond which further applications are uneconomical); (2) the amounts of superphosphate needed to raise the soil test from a low to optimum level; (3) the maintenance rate of superphosphate needed to keep the soil test at optimum for pasture production.

That approach, whereby soil phosphorus tests are used to monitor a topdressing programme, should be of far greater value under New South Wales conditions than is the conventional soil test technique based on calibration curves.

Soil Surveys

Mid Clarence Valley.—The field work is complete and the report in hand.

Upper Clarence Valley.—A rapid field survey indicated that the methods of Stratomorphic-Terrain Analysis surveying could be applied directly to this region.

Wagga Agricultural Research Institute Soils.—A report on these soils, with special reference to newly acquired areas, has been completed for use of the Wagga Wheat Research Institute.

Grafton Agricultural Research Station Soils.—A preliminary survey has been undertaken. A draft report on the recent acquisition is completed. The whole Research Station area will be surveyed in August, 1970.

The C. B. Alexander College, Tocal.—Preparations for the soil survey are in hand with a view to an early report on the property.

Trangie Agricultural Research Station.—A report of a soil survey of a portion, in relation to irrigation development, was issued. Further field work on the same area was done in January-February, 1970. This was to examine the infiltration characteristics and water movement behaviour of the various soils; to find a method of assessing the suitability of an area for irrigation layout and design. A preliminary report on the findings has been issued.

Additional tests are to be done, to help further assessment of the suitability and behaviour of soils to irrigation. Most analyses will centre on the physical properties of the soil. The findings and results may help to predict further irrigation land use in other areas. A new soil physics laboratory is being set up for the purpose.

Nitrogen Research—Central Western Wheat Soils

Twenty-nine trials at Trangie, 9 at Condobolin, and 7 at Cowra were sown; May to July, 1969. Duplicate analyses on all soil samples for these trials were made for ammonium and nitrate at sowing, and for total nitrogen. With available moisture data from various critical periods of the growing season, these results are to be correlated with grain yield response by wheat at harvest; when results from all years 1965 to 1970 are statistically examined.

Aerobic and anaerobic incubations (related to the soil's nitrogen-supplying power) were applied to a few 1968 soils. But because results from aerobic incubations often have shown considerable variation between triplicates, attempts are being made to correct this error before proceeding further with this test.

Since soil moisture has an appreciable effect on nitrogen uptake by the plant, the Collis-George filter paper method to determine the moisture characteristic of the soils has now been applied to all of the 1968 soils. In particular the moisture percentage at wilting point and field capacity are important.

Soil Potash Survey

Field work for the pilot portion of this survey (part of the South Coast and Southern Tablelands Survey), the chemical analysis, and the voluminous statistical analysis, were completed. An article on the results is in draft, for the *Agricultural Gazette of N.S.W.* Later a paper will be prepared for a science journal.

The original plan to survey the whole of the Coast and Tablelands for soil potassium levels can now be reviewed in light of results from the pilot survey.

The time taken (22 months) to cover the several parts of the pilot potassium survey has indicated that coverage of the whole of the coast and tablelands would take too long. Therefore, alternative statistically-rated procedures for sampling the remainder of this area are being considered. The survey is in abeyance pending solution of a current staff-shortage problem.

This year a paper on estimation of non-exchangeable potassium in soils using a cation-exchange resin was published.

Manganese Toxicity Project

The Terranora Work.—A publication on the 3 years' experimental work at Terranora has been submitted to the *Australian Journal of Agricultural Research.*

The Alstonville Work.—The first manganese toxicity trials at the Tropical Fruit Research Station, Alstonville, ended in the 1969 summer.

Analytical work on soil and plant samples is near completion. Evaluation of the results is progressing, both for magnesium compounds to correct manganese toxicity and for effect of chlorides (potassium chloride) on release of manganese.

Soils Advisory Service

Volume of Work on Samples.—Some 3,356 soil samples were received this year (decrease 12·5 per cent). These involved the writing of 682 reports (decrease 9·5 per cent); on average, 4·9 soil samples (5·1 last year) per report.

This large volume of work remains excessive for the 1 Chemist and 1 Technical Officer (Scientific) involved. Half-time assistance by a newly appointed laboratory attendant (preparing soil samples) was an improvement this year.

Experience for Overseas Chemists.—A feature of the Soils Advisory Service is the number of overseas chemists who gain experience here in soil testing methods. Mr A. Awad from Egypt and Dr C. E. Lewis from England are now employed by the Department at Wollongbar. Mr U. Lynne spent some time with the Service and has since returned to Burma. Mr W. P. C. Ntsekhe now undergoing training will return to Lesotho. International relations are being fostered by this extra training work.

High School Lectures.—Mr J. H. Bull is giving some instruction to Bankstown Boys High School students in agricultural chemistry; a development sponsored by the Royal Australian Chemical Institute.

Some Miscellaneous Research

Some research is proceeding into the cobalt status of coastal and tableland soils, relating to rhizobia. This work was started because of a continuing large flow of soil samples associated with faulty lucerne growth from those areas.

Soil Samples from Prospective Irrigation Farms

Many soil samples were received from prospective irrigation projects, following the trend away from dryland farming. Use of gypsum has considerable importance in soils from some of these areas.

CHEMISTRY LABORATORY, YANCO

Rice Chemist Mr M. Horth began work at the Yanco Agricultural College and Research Station Laboratory in October, 1969 after 6 months at the Biological and Chemical Research Institute, Rydalmere. At Rydalmere he worked on the quality-analyses of rice varieties (see page 186) for the Rice Breeder, Yanco.

The research programme now being conducted at Yanco is to elucidate factors causing nitrogen-response fluctuations of rice grown in the M.I.A. This is being approached from 2 angles: (1) the importance of microbial denitrification of applied nitrogen fertilizer; (2) improvement of the soil-nitrogen test for more accurate measurement of the fertility of rice soil.

DAIRY CHEMISTRY AT HAWKESBURY COLLEGE

Dairy Chemist Mr H. Dengate, located at Hawkesbury Agricultural College continued the survey of chemical composition of local cheeses.

The Australian Dairy Board Project on relationship between chemical composition and cheese-grading of export quality cheese has started. Satisfactory rapid methods of analysis to deal with large numbers of samples were established.

Survey of the copper contamination of New South Wales butter was completed. A paper has been submitted to the *Australian Journal of Dairy Technology.*

CHEMISTRY LABORATORY, WOLLONGBAR

The current work at Wollongbar Agricultural Research Station by Chemist Mr A. Awad is in support of pasture and animal research. It is providing a co-operative analysis service for the Research Station officers conducting plant and animal projects, and providing opportunities also for research work by the chemist himself.

In all, 4,747 analyses were done this year; 3,383 in co-operative work. Of the 4,747: 1,321 were for Kjeldahl nitrogen, 550 for phosphorus, 600 for potassium, and 500 for calcium.

His own research programme centres around two projects: (1) the effect of phosphorus and liming in correcting adverse effect of high ammonium sulphate application on kikuyu pasture; (2) assessment of mineral composition of some local pastures, and change in mineral composition.

DECENTRALIZED AGRICULTURAL RESEARCH DIRECTORATES

Agricultural Research Institute, Wagga Wagga

WHEAT IMPROVEMENT

Yield Trials

Conditions.—Conditions in 1969 favoured a widespread epidemic of stem rust in Southern Region, perhaps more severe than any epidemic in the past 20 years. Leaf blotching (*Septoria tritici*) was also widespread. In the central west, frost damage was a dominant feature of the early sown trials and caused complete failure of many varieties and crossbreds.

A.R. Falcon 28A ("*Eagle*").—This stem-rust resistant crossbred proved resistant to all naturally occurring races of *Puccinia graminis tritici* and generally out-yielded Falcon. It has been registered as Eagle.

Crossbred W.W. 15.—This crossbred again performed outstandingly. Also, significant progress has been made towards its conversion from a red to a white grained strain and many such lines have retained the excellent milling quality of W.W. 15 itself. These will be evaluated in the 1970 season for yield.

*Crossbred M*1313.—This soft grained winter crossbred maintained its yield performance, equivalent to that of Olympic. It might well find a place in commerce to meet the often expressed wish of growers for a variety suitable for early sowing. M1313 has high milling quality, possesses a strong though tall straw and, while having potential as a biscuit wheat at low protein levels, is at least equal to Olympic as a bread wheat at high protein levels.

Semi-Dwarf Falcon Derivatives.—Extensive testing of a group of these during 1969 has led to selection of one, designated DARF. PA 134–2.

*Crossbred M*1238–2.—This widely tested crossbred was rejected by the Uniform Quality Testing Committee because of excessive grain hardness. It is also particularly susceptible to stem rust.

*M*1224–2.—This performed well among the later maturing wheats and again showed valuable resistance to *Septoria tritici.*

The Five Recommended Varieties in Trials.—Olympic performed best, followed by Falcon. Gamenya was variable. Robin, unless frosted, was generally superior to Heron. Heron has a fine yield record, but performed poorly in many trials. Wet years apparently do not suit this variety.

Halberd and Darkan from Interstate.—Halberd from South Australia and Darkan from Western Australia each did well in this first trial in New South Wales. Halverd has a particularly good yield record in South Australia. In terms of replacing Heron and Robin it unfortunately appears to have some undesirable quality characteristics.

Hard and Soft Wheat Production

This year has been accompanied by a change of outlook concerning varietal types in southern New South Wales. Widespread lift in soil fertility has so raised protein levels that a switch to production of hard wheat on such improved soils has been deemed advisable.

A "Hard and Soft Wheatgrowers Association" has been formed to promote the production and segregation of both hard and soft wheats more nearly meeting the current market demands.

A large scale evaluation was made of Falcon. This is now recommended for throughout the southern wheat areas.

Soft wheat production is being further encouraged in the irrigation areas, where lower protein levels usually prevail. Unfortunately, staffing difficulties have set back the programme of breeding soft wheats for the biscuit industry.

Hybrid Wheat

For several years the basic procedures underlying development of varieties suitable as parents in the production of hybrid wheat has been studied. Male sterile and restoring lines have been produced, using Heron and Triple Dirk as donor parents.

Field experiments have revealed basic problems in the pollination of male sterile lines where, during the past 2 years, male sterile Heron sown alongside Heron has had a very much reduced seed set (approximating 40 per cent).

Genetics of Growth Habit

A very wide range in responsiveness to vernalization has been found among a group of winter wheats studied during the past 10 years. The basis of these differences appears to be determined by multiple alleles at three loci. The behaviour of crosses between spring and winter varieties appears to depend on the operation of any one of three dominant inhibitory genes borne by the spring varieties.

A search for mutants differing in developmental patterns is being made in a population of Early Thatcher after treatment with ethylmethane sulphonate. The plants are being grown under short days with a view to selecting mutants insensitive to day length.

Wheat Cytogenetics

The programme has involved alien-chromosome addition and substitution procedures, genetic analysis using aneuploid techniques, a synthesis and developmental study of Triticales, and studies of homoeologous pairing and recombination of *Aegilops* species with wheat.

Alien-Chromosome Addition to Wheat.—Further studies were made of Heron—*Secale cereale* addition lines; their stability, fertility, and cytology.

A further backcross was made to the wheat = *Agropyron* amphidiploid, to produce 43 chromosome addition lines. This cross is being pursued in the hope of deriving the high level of *Ophiobolus graminis* resistance of *Agropyron caninum* in wheat, initially as a chromosome = addition line.

A cross of Robin with the amphidiploid of Chinese Spring x *Haynaldia villosa* has been made, in an effort to produce a chromosome-addition set of *Haynaldia* in the Robin background.

Alien-chromosome Substitution in Wheat.—Three Heron-rye addition lines are being used in a programme of substituting rye chromosomes for those of the B genome of Heron. The aim has been to study wheat-rye homoeology and to observe the potential of alien chromosome substitution as a breeding technique. This will be assessed on the basis of such characteristics as fertility, stability, and general phenotypic performance of such substitution lines.

Genic Male Sterility.—Crosses of the 21 Chinese Spring monosomics with the genic male sterile Chancellor cultivar have been made, to locate the gene controlling this character.

Genes for Vernalization Response in Homoeologous Group 5.—The genetic influence on vernalization-response of homoeologous group 5 has been shown to be due to genes on each of the three chromosomes 5A, 5B, and 5D. This was achieved from a genetic study of the F_2 populations of the crosses of the substitution lines Chinese Spring/Hope 5A, 5B, and 5D each with normal Chinese Spring. While the genes on 5A and 5D of Hope have a profound influence on vernalization response, that on 5B is comparatively of minor effect.

Triticale Investigations.—Agronomic observations have been made on a wide range of introduced octoploid and hexaploid Triticales. Preliminary investigations of developmental behaviour have been made. A crossing programme to produce hexaploid Triticales using a range of *Secale cereale* strains and different *Secale* species with dwarf tetraploid wheat has been continued.

Aegilops = Wheat Hybrids.—Hybrids of *A. variabilis*, *A. comosa*, *A. ventricosa* and *A. ovata* with Chinese Spring, nulli-5B tetra-5D, have been studied cytologically for homoeologous pairing and backcrossed to Robin. This is in an attempt to extract possible *Aegilops* recombinations in wheat.

Wheat Quality Investigations

The micro milling and baking techniques referred to last year have undergone slight modifications. This is with the aim of making them even more effective as a means of quality screening of early generation crossbreds. Particular attention has been devoted to micro-milling. The modified technique shows some promise of providing a preliminary assessment of "millability" on small samples of wheat.

Collaborative testing of soft biscuit-type flours has been made with the biscuit industry, to confirm agreement in instrument calibration before receipt of samples from the Institute's breeding programme. With this calibration of the normal equipment established, needs of the biscuit industry in terms of the Institute's "mini" extensograph technique have been determined. Thus, early detection of potential biscuit-type wheats will be possible when seed supply is limited.

Study of the relationship between some mini-extensograph characteristics and oxidation status in micro baking-test doughs is being continued with this year's early generation crossbreds.

In keeping with the industry's demand for better milling quality, the Institute is discarding more heavily on the basis of "millability". This has not affected current advanced crossbreds. Some of these have excellent milling characteristics.

OAT IMPROVEMENT

Trials

The 1969 season was particularly favourable. Following good late summer rains, trials were sown at the earliest date yet attempted (14th February).

Five grazings by sheep were possible and record dry matter yields were obtained. Cooba was again outstanding, with a dry matter production of 39·5 cwt per acre. P4315 and Algerian were the next best in green forage production followed by two new crossbreds A.O.T.B. x Coolabah (M 1355) and Coolabah x 2 Victorgrain Fulmark^2 (M 1354).

Grain yields were relatively low after such heavy grazing but M 1354 produced 54 bushels per acre and M 1355, 47 bushels per acre, compared with Cooba 37 bushels per acre. Cokers Osage[2] (M 1341) has outyielded Avon by 18 per cent in ungrazed trials over the past 3 years but has small grain and thus is not likely to be acceptable for milling purposes.

Disease Problems

The heaviest epidemic of stem rust in 15 years caused marked yield reductions in susceptible varieties. Swan, Irwin, and Avon were the most susceptible, while Cooba, P 4315, Cokers Osage[2], and Acon-Osage showed good field resistance. Rust was also responsible for low bushel weights and high husk percentages.

Smuts were also prevalent. A very high incidence of loose smut (*Ustilago avenae*) occurred in seed-increase blocks of the crossbred Avon-Osage and caused its withdrawal from commercial production.

Nitrogen Fertilizer Trials

The results of trials extending over the years 1966–68, covering varietal responses to nitrogen fertilizer dressings at varying seeding rates, have been prepared for publication.

WEED INVESTIGATIONS

Skeleton Weed (*Chondrilla juncea*)

Herbicide Translocation.—Studies of translocation in mature skeleton weed were continued. The herbicides 2, 4-D (1 and 2 lb a.i.), dicamba (1 and 2 lb), tricamba (1 and 2 lb) and picloram (½ and 1 oz a.i.), with or without a supplementary application of ethrel (1 lb an acre) 1 week later, were applied to 6 months old and 18 months old skeleton weed plants in the glasshouse.

Fourteen days after the initial application, 2, 4-D, dicamba, and picloram had killed the root to a depth of 20 cm and tricamba to 12 cm. Regeneration was retarded for a short distance below these levels, but once again there were indications of regrowth stimulation at some depths tested. Older plants were killed to a greater depth than younger plants but ethrel had no effect on depth of kill.

There was marked herbicide/age response with the benzoic acids. Kill was greater in the 6 months plants with dicamba and in the 18 months plants with tricamba. This interaction gives some explanation for previously observed improved field control with tricamba as compared to dicamba.

Cultivation and Pre-planting Treatment.—Cultivation to 25 cm, and pre-planting application of chemicals, several months before sowing, reduced skeleton weed populations at sowing. This was by comparison with Australian commercial practice. But, whereas weed populations remained low on chemically treated plots, those on the deep cultivated plots were no different from control plots at harvest.

Picloram 8 oz a.i. applied 12 months pre-planting, and 4 oz a.i. applied as a split dressing (2 oz + 1 oz + 1 oz), respectively 6, 3, and 1 month pre planting,and dicamba 6 oz 1 month pre-planting, increased wheat yield. Dicamba 3 lb a.i., picloram 4 oz, and 2 oz, and 2, 4-D 1 lb, applied respectively 12, 6, 3, and 1 month pre-planting either had no effect on or reduced wheat yield. Residue problems with picloram are apparent.

Paterson's Curse (*Echium lycopsis*)

Exploratory Herbicidal Work.—Because of rapid increase in importance of this weed in Southern Region, and an apparent break-down in the recommended control measures, exploratory work with some of the available herbicides was started.

Amine 2, 4-D, sodium MCPA, bromoxynil, CMPP, prometryne, atrazine, methabenzthiazuron, diquat and some mixtures of 2, 4-D, or MCPA, with bromoxynil, the triazines and the substituted urea were applied at logarithmically reducing dose rates. These were to a heavy infestation of young Paterson's Curse (90 per cent ground cover).

All herbicides applied gave excellent control at peak dose rates (2 to 4 lb an acre) but some damaged the pasture species at these rates. The mixtures of 2, 4-D 1 lb constant, or ½ lb constant, with bromoxynil 1 lb reducing, atrazine ½ lb reducing or methabenzthizauron 1 lb reducing and MCPA 2 lb + bromoxynil 2 lb (both reducing) gave excellent control over the range of rates tested (peak dose to ⅛ peak dose). An examination of lower dose rates is indicated.

Applications of these herbicides to later growth stages and a general survey of the Paterson's Curse infestations in the region are in progress.

Weed Control in Wheat

Skeleton Weed.—In post-emergence trials, picloram, picloram/2, 4-D, and picloram/MCPA mixtures were applied at 0·25, 0·375, and 0·75 oz a.i. picloram per acre to wheat at the 3-, 5-, and 7-leaf growth stages. Skeleton weed was suppressed at all rates and times of application.

Formulation had no effect on the results but grain yield was reduced as time of application was delayed after the 3-leaf stage. Grain yield increased with an application rate of 0·25 oz picloram and decreased with 0·75 oz picloram.

Other Weeds.—Post-emergence applications of diruon/bromoxynil mixtures effectively controlled *Amsinckia* spp., *Lolium rigidum*, and *Vulpia bromoides*.

At application rates of 1 and 2 oz a.i. bromoxynil per acre, increasing the diuron from 0 to 4 oz an acre increased the grain yield. But with bromoxynil at 4 oz an acre each increment of diuron reduced the wheat yield. Trifluralin 8 oz, 16 oz, and 24 oz a.i. an acre, applied 1 month before planting, triallate 12 oz, diallate 16 oz, and dichlobenil at 8 and 12 oz a.i. applied pre-emergence, all incorporated with spike harrows, and C 2242 at 24 and 40 oz and chlorbromuron at 24 oz a.i. applied at pre-emergence, without incorporation, gave 80 to 90 per cent control of Wimmera ryegrass in wheat.

Trifluralin 8 oz, triallate, diallate, C 2242 at 40 oz and chlorbormuron increased wheat yield. Trifluralin 24 oz, dichlobenil 12 oz and MSMA 6 lb post-emergence reduced wheat yield. Trifluralin, C2242, chlorbromuron, and dichlobenil controlled the subsequent germination of *Polygonum aviculare*.

Weed Survey in re Wheat Yields

A third survey of the effect of weeds on wheat yield was completed in 1969. At 31 representative locations, yields of wheat suppressed by a variety of weeds were compared with yields of wheat where the effect of weeds has been removed by repeated hand weeding.

On average, weeds reduced wheat dry matter yields at flowering by 7·3 per cent and grain yields by 11·5 per cent. The effect of weeds in 1969 was not as great as in 1967 and 1968. Whether this was due to a generally smaller weed component or to 1969's more favourable weather conditions has not yet been established.

A weed survey will be done again in 1970, and this will end the project.

PLANT PATHOLOGY

Systemic Fungicides and Cereal Diseases

Loose Smut of Wheat and Barley.—Contrary to the previous two seasons wherein it gave perfect control of loose smut of wheat, vitavax (75 per cent carboxin) gave only 75 per cent disease control. Disease control obtained with benlate (50 per cent benomyl) was 93 per cent and quinolate V-4-X (a combination of carboxin and copper-8-hydroxyquinolate) 94 per cent. As in 1968–69, vitavax was superior to benlate on loose smut of barley; respectively 100 per cent and 68 per cent disease control.

Several new systemic materials were screened. Some of these justify further evaluation.

Flag Smut of Wheat.—In extensive field trials, vitavax gave excellent control of both seed- and soil-borne flag smut whereas benlate was moderately effective. The reference chemical (ceresan) controlled seed-borne smut only.

Gabo and Olympic wheats were used in the trials, Olympic because during the 1968–69 season the Olympic crop in the paddock used for the trial was heavily infected with flag smut. Olympic is generally listed as moderately resistant to this smut whereas Gabo is very susceptible. However, for untreated seed sown on naturally infected soil, Gabo had 15 per cent smutted plants and Olympic 35 per cent. The high susceptibility of Olympic was subsequently confirmed in pot experiments.

Bunt of Wheat

Testing of fungicides for control of bunt continued. Some chemicals with a good degree of activity have been found during the last few years but none of these has given the consistently good control obtained with PMA and HCB.

In a paddock where in 1968–69 an Olympic crop had been very heavily infected with bunt, the importance of soil-borne infections was explored. A number of susceptible varieties were sown under conditions favouring the take of the disease. Although the artificially contaminated reference seeds were heavily infected, no plants were bunted from the natural soil infection. This confirmed that bunt spores that pass the summer in the soil play no role in the carry-over of the disease.

Using a range of tester wheats from the U.S.A., race determinations were carried out on the *Tilletia foetida* collections maintained at the Institute.

Powdery Mildew of Wheat

This disease interferes seriously with wheat work in the glasshouse. Two systemic fungicides, milstem and benlate, were applied as seed dressings. These protected the plants for many weeks. Plants grown in soil to which one of the chemicals was added were completely free of mildew to maturity. Established mildew could be eradicated with one application of a soil drench containing one of the chemicals.

Septoria tritici

Many wheat cultivars and lines were field tested for susceptibility to *Septoria tritici*. A few showed a promising degree of resistance or tolerance.

PLANT PHYSIOLOGY

Crop Behaviour

A co-operative project with the Macquarie University was started in 1969. The aim was to evaluate potential and actual evapotranspiration in relation to climate, crop growth, and development, density of plants, and soil moisture potential. Initially the treatments involved are 2 times of planting and 2 densities (23 and 103 lb of Heron seed per acre). Plot sizes are 15 and 20 acres.

Data are automatically recorded using a digital volt meter and a paper tape punch. Data include total and net radiation, albedo soil heat flux, wind speed and direction, wet and dry bulb temperatures, and rainfall.

A satisfactory design for a lysimeter installation is being developed with the CSIRO.

Water-use Efficiency in Wheat

The experiments into the water-use efficiency and physiological basis for yield differences between wheat varieties were continued. These are now being analyzed.

A study to assess varietal differences in physiological efficiency of grain production in commercial crops has been completed. The outcome is being prepared for publication.

PASTURE INVESTIGATIONS

Stocking Rates/Superphosphate Rates Trials

The pasture phase of this trial at the Institute ended in 1968. The results are being prepared for publication.

Additional trials were established in mid-winter 1969 in co-operation with 4 local farmers. Each farmer made available an area of about 50 acres as well as 100 Merino ewes. Commonwealth Extension Services Grant funds provided the necessary staff, materials and equipment.

The latter half of 1969 was an "equilibrating" period permitting the adjustment of the animals to their new pasture environment. Intensive observations were started in February 1970. Already the various treatments have had a marked influence on botanical composition of the pastures.

Management and Time-of-Lambing Experiment

The Situation.—Lambing time is controversial in the Region. This is apparent in the following figures, on district lambing times, for production of second cross prime lambs (expressed as a percentage of the total of sheep mated).

Lambing time	Kyeamba shire	Mitchell shire
	Per cent	Per cent
Autumn	18·6	45·1
Winter	29·2	23·0
Spring	41·8	25·3

Experiment Design.—Current research is aimed at determining the most suitable lambing time for production of prime lambs in the Region. Four different systems are being used in a way that will compare 2 lambing times and also permit observations on the effects of particular management practises on lamb and wool production.

The 2 lambing times in the trial are early winter and spring. Early spring in this context is August–September. The 4 management systems are as follow:

(1) *Set stocked.*

(2) *Rationed:* The sheep are kept on one-half of their area for 4 weeks after the autumn "break", or up to mid-June if the "break" is late. In the spring the areas grazed in autumn are closed up for 4 weeks and cut for hay.

(3) *Rationed; plus* 50 *per cent green feed as a supplement:* The supplement is intended primarily to top-off lambs. In the winter-lambing group the supplement is Cooba oats. In the spring-lambing group the supplement is lucerne. The supplementary areas are cut for hay (lucerne) or harvested for grain (oats) in spring. In the autumn the spring-lambing groups graze the lucerne while the subclover/ryegrass is deferred. The winter-lambing groups graze the stubbles in late summer and the oats as soon as it is ready in June.

(6) *Rationed; plus* 25 *per cent oats and* 25 *per cent lucerne:* The supplements are again primarily for use by the lambs. Thus the lucerne is used by the lambs of the spring-lambing group while the oats is used by the ewes during pregnancy. The grain may be fed in the late summer if necessary, before mating. In the winter-lambing group the oats is used by the lambs and the lucerne used to lift ewe-condition before mating. This treatment is an attempt to fill the 2 areas of reduced production of subclover/wimmera ryegrass.

Superimposed on those systems are 2 per acre stocking-rates; 5 and 3·3 breeding ewes (Border Leicester/Merino) mated to Dorset Horn rams. There are 3 replications in the factorial arrangement.

Bodyweight, wool production, lambing performance, and pasture changes are recorded.

Progress.—The trial started to produce data with the first spring lambing; in September, 1968. There was no winter lambing that year. Data from lambings in 1969 are now available but the extraordinarily good late-summer rains and consequent very good pasture year have had to be taken into account.

Consistent throughout has been the tendency for set-stocked and rationed treatments to be the best producers of mutton per acre, with the higher stocking rate better than the lower stocking rate.

The same trend has been evident for wool production. With only one exception the set-stocked and autumn deferred treatments were the best wool producers. The difference between these and the other treatments appears to be widening as the trial proceeds.

Lucerne Grazing Trial

The Situation.—In the Wagga environment the main pasture used for sheep production is subterranean clover and annual grasses. The pasture provides green feed from autumn, after the germinating rains; through winter, when growth is slow; to spring, when abundant dry matter is produced. In summer the sheep have to survive on dry residues. Some value has been placed on subterranean clover burr, though actual intake of burr is not documented.

Lucerne, however, will grow very quickly at high temperatures and can produce summer green feed in response to showers. Wagga's rainfall pattern indicates an average rainfall of at least 1½ inches each month. During the winter, from June to mid-August, lucerne achieves almost no growth. Therefore, *either* of 2 roles can be considered for lucerne: (1) a special purpose pasture to provide green feed supplementation when the basic pasture merely provides dry residues; *or* (2) a component in a mixed pasture so managed as to encourage maximum growth of all components. By experiment, the latter role of lucerne is being investigated.

The Experiment.—To examine the management of the lucerne component only, rather than try to resolve the effect of management treatments on both lucerne and annual grass/clover, the year has been divided into 2 phases; a summer or lucerne phase, and a winter or annual grass phase.

In the winter phase, management is not varied. All plots are rotationally grazed on a 3-paddock system. Each paddock is grazed for 15 days and allowed to recover for 30 days.

In the summer phase, lucerne management is being examined by means of 2 systems: a 3-paddock system managed the same as the winter phase; and a 9-paddock system wherein the paddocks are grazed 5 days and allowed to recover for 40 days.

Change from winter phase to summer phase occurs when lucerne starts to make a significant contribution; usually in early September. The change from summer to winter phase occurs when annuals start to make a significant contribution; usually shortly after the autumn break.

There are 2 stocking rates; 4 and 6 breeding Merino ewes/acre, mated to lamb in spring. There are 3 replications. Bodyweights, wool production, and lambing performance are recorded. Pasture assessment is carried out every 45 days.

Progress.—Bodyweight and wool production data so far indicate no effect of subdivision, but a marked effect of stocking rate. On the other hand, plant-density counts in January 1970 indicated that the 9-paddock system permitted better lucerne survival than the 3-paddock system. But this difference in plant density was not reflected in bodyweight differences. Thus it would seem that the annual grasses provided an adequate substitute for lucerne in the 3-paddock system.

Perennial Grass Trial

The Situation.—Large areas of perennial grasses are sown in the Wagga region. But without evidence that such pastures are better than the easily established annual grasses and subclover.

Recently the CSIRO released a phalaris variety "Sirocco". Though better than commercial phalaris for persistence and herbage yields, Sirocco needs comparison with subclover/wimmera ryegrass for animal production.

The Experiment.—A trial has been started to evaluate the following pastures: subclover and wimmera ryegrass; subclover and Sirocco; lucerne *var.* Hunter River and Sirocco, sown in pairs of alternate rows; lucerne *var.* Hunter River.

The pastures are stocked with dry Border Leicester/Merino ewes at 5·4 and 3·6 sheep per acre; 5 per plot, replicated 3 times, making 15 per treatment. All plots containing lucerne are to be rotationally grazed in a 4-paddock system, with 2 weeks grazing and 6 weeks recovery.

Progress.—Sheep were placed on the plots on 25th August, 1969. The pasture has reached a state of near equilibrium with the animals, and data collection has started.

AGRONOMY AND FERTILIZERS AND SOIL CHEMISTRY

Fallowing and Wheat Production

The evaluation of spring and autumn fallows, as against minimum cultivation techniques involving the use of a herbicide, was continued—relative to southern New South Wales. Three experimental sites were harvested in 1969 and 2 sites prepared and sown for the 1970 season. Comparisons of the total moisture in the soil profile at sowing, at 7 sites, over 3 seasons, showed little advantage in favour of long fallows.

The results suggest that, on the dominant soil type of the region, long fallows as currently practised cannot be justified on economic grounds. However, prepared seed beds can allow earlier sowing after light rainfalls. This is not possible on unprepared ground. Conversely, after heavy autumn rain, sowing is usually delayed on cultivated seed beds. This is not so with chemically prepared ground.

Nitrogen Soil Tests

Feasibility Investigations.—Investigations into the feasibility of using nitrogen soil-tests for wheat production in southern New South Wales is continuing in several concurrent programmes.

The results of a glasshouse evaluation of a series of biological and chemical methods for determining available soil nitrogen have been published. The usefulness of these measures of available soil nitrogen for surface (0–10 cm) and subsoil (10–30 cm) samples in accounting for the variability in wheat yields under field conditions was evaluated by linear regression techniques.

Single soil tests, such as total mineral nitrogen (0–10 cm sample) could account for only 38 and 18·5 per cent of the variation in yield at flowering and harvest respectively. However, the use of a bilinear regression involving water-soluble nitrogen in the surface horizon and nitrate nitrogen in the subsoil accounted for 64 and 36 per cent of the variation in yield at flowering and harvest respectively.

Determination of critical levels of available soil nitrogen below which wheat will respond to nitrogen fertilizer continued. Preliminary assessment has been made of data collected from 223 simple nitrogen fertilizer x wheat experiments conducted during 1969–70.

So favourable were seasonal conditions in 1969 that yield responses to the 30lb nitrogen/acre, broadcast as ammonium nitrate shortly after sowing, were obtained in the 3 (low, medium, and high) tentative soil-nitrogen classes. But the responses were negatively correlated with the soil nitrogen assessments: 9·8 bus./acre in the low soil-nitrogen class, 5·2 bus./acre in the medium-nitrogen class and 2·8 bus./acre in the high-nitrogen class. Moreover, control yields and responses to nitrogen were superior in the eastern part of the study area for the third year.

Because this study was started in the drought year, a decision was made to extend it for a further season. So, 232 likely experimental sites were located early in 1970 and 219 of these were soil-sampled before sowing. The lesser number of sites obtained in 1970 reflected the depressed wheat situation in the study area.

Use of these tests as predictors of the nitrogen fertilizer need of wheat will involve measurement of climatic, cultural, and edaphic factors as well as the response to nitrogen fertilizer. Regional fertilizer trials (nitrogen and phosphorus rates) which involve time of sowing, time of application of nitrogen fertilizers, and the measurement of various climatic and edaphic parameters, have been started. These are to determine the value of nitrogen soil tests for predicting fertilizer requirements.

Soil Sampling.—The accuracy of various measures of available soil nitrogen depends upon the intensity of soil sampling adopted. Twenty composite samples, of 10 soil cores each, were collected from representative wheat fields (40–150 acres) in southern New South Wales.

The range of mean values obtained, the overall mean for the fields, and the standard deviation of a composite sample of 40 cores for several measures of soil nitrogen, are tabulated:

Soil Test	Range	Mean	± Std Dev. (40 cores)
Total N (per cent)	0·074– 0·140	0·105	0·005
Mineral N (ppm)	5·2 –29·0	10·6	3·1
Incubation NH_3N (ppm)	10·0 –46·7	30·8	4·9
Water Soluble N (ppm)	25·6 –75·8	57·4	6·5

Nitrogen Fertilizer and Wheat

Highlight of the 1969–70 series of fertilizer trials has been the spectacular performance of nitrogen fertilizer on wheat. In all but one of the trials, grain yields were increased after applications of nitrogen. In previous years, significant increases in grain yield attributable to nitrogen have been the exception rather than the rule. The explanation is thought to be in the climatic conditions. Accordingly, investigations of the association between nitrogen behaviour and weather pattern have been initiated.

Nitrogen and Phosphate Trials with Wheat

Fourteen trials of N and P fertilizer on wheat were established. The trial design was 4 x 4 factorial with 3 replicates using 22 per cent superphosphate drilled with the seed at rates of 0, 50, 150, and 300 lb/acre and ammonium nitrate at 0, 15, 30, and 60 lb N/acre topdressed at sowing. Wheat variety Heron. Soil samples from 0 in to 4 in and 4 in to 12 in were collected before sowing for N and P determination.

In August, plots on 3 trials were split for an additional dressing of 30 lb N/acre applied broadcast.

Results from 2 of these 3 trials showed an increase in grain due to N and P and the additional N gave further increases. In the third trial, situated in a drier area, N depressed yield and P had no effect. Of the remaining 11 trials, 2 had to be abandoned because of weed development. The remaining 9 were harvested successfully. Grain yield was increased in every case by nitrogen and in 7 cases by phosphorus.

Forms and Method of Application of Nitrogen

Sulphate of ammonia, urea, and ammonium nitrate were drilled and topdressed in 2 trials on Heron wheat sown with 100 lb/acre of 22 per cent superphosphate. Rates were 0, 20, 30, and 40 lb N/acre.

In both trials, grain yield increased with succeeding rates of nitrogen. In both trials, urea was the least productive form of nitrogen; ammonium nitrate being superior in 1 trial and ammonium sulphate in the other. In 1 trial, drilling was significantly better than topdressing. In the other there was no difference between methods of application.

Two trials were established to compare the performance of the following fertilizers—22 per cent superphosphate, 44 per cent Hyfos, 12:52:0, 11:29:0, 18:18:0. Rates of application were 18, 27, and 36 lb/acre. Heron wheat was used in both trials.

The 3 N P mixtures gave higher yields than either of the 2 phosphate fertilizers; all fertilizers were superior to the control; and the greater the total N applied, the greater the yield.

These results must be interpreted with care because results from other trials in 1969 indicated that conditions were particularly favourable for the use of nitrogen fertilizer.

Soil Phosphorus

The Soil-Testing Pilot Service.—This service in respect of phosphorus and wheat completed its first year. Farmers successfully harvested test strips on 148 of the 212 paddocks sampled. This was a good percentage since the sowing and harvesting of the strip involves additional effort by the farmers, at busy periods. The work of the Field Officer, seconded to the Pilot Service from the Division of Plant Industry, contributed appreciably to the success.

Fewer farmers will fail to sow or to harvest test strips this year. They are better acquainted with the needs of the Service. Moreover, soil sampling was completed earlier this year.

Statistics of sampling for the current season are:

	Leeton	Wagga	Cootamundra	Albury
Farmers	22	75	53	38
Paddocks	23	83	61	40
Samples	56	138	111	55

The following comparisons between 1969 and 1970 show that the sample of farms and paddocks represented in each year has been very similar.

	Average rainfall (in)	Average phosphate level (ppm P)	Average pH
1969	21·4	24·9	4·9
1970	21·2	23·0	4·8

Fertilizer Nitrogen Reactions in Soils

Problems that arose in the study of the non-exchangeable ammonium fraction of soil nitrogen in 6 soils from the region have been overcome and a programme is under way to evaluate the importance of this nitrogen fraction in the efficient use of nitrogen fertilizers.

Possibility of a link between level of non-exchangeable ammonium and the total carbon content of clay minerals was investigated. There seemed to be no relationship between these 2 measurements in 2 soils from the region, but 4 more soils will be studied.

Volatilization loss of ammonia from cereals topdressed with urea and ammonium nitrate has been measured. Glass containers, fitted with glass wool pads acidified with sulphuric acid, were inverted over the test area for periods up to 7 days. Volatilized ammonia was collected and determined by alkaline distillation. Results, although variable, indicated that up to 12 per cent of nitrogen applied as urea (at 20 lb N/acre) can be lost to the atmosphere.

Agricultural Research Directorate, Tamworth Station

GENERAL

Fire Effects

Fire destroyed the nitrogen digestion apparatus and severely damaged the roof of the main laboratory building. No records were lost, but most research programmes suffered some upset and delay. Programmes depending on chemical analyses of soil and plant material for nitrogen and phosphorus content were most affected.

PASTURES AND FORAGE CROPS RESEARCH

Work reported under this section includes several projects in which officers of the Divisions of Plant and Animal Industry co-operate with staff of Tamworth Station.

Agronomy

The pasture research programme was in considerable detail in the 1968–69 report. Results from studies on the coarse granite soils of the southern New England Tablelands have confirmed those from previous years. The studies are being terminated. The present report is concerned primarily with the arable soils of the northwest Slopes.

A programme to examine animal performance on currently utilized pastures and forage crops in the region has been in progress for almost 4 years. It has indicated the contribution of these species to the seasonal feed needs of grazing animals in this environment.

Lucerne

A 6-paddock rotational grazing system conducted for 3 years to December, 1969 successfully supported 6 dry sheep per acre (second cross Border Leicester-Merino ewes). However, feed shortages in winter, and frequently in late summer-early autumn, could adversely affect the potential of lucerne alone for supporting breeding sheep.

Summer Forages (Forage Sorghums)

The hybrid Sudax and *Sorghum almum* have been examined under grazing over the past 3 summer seasons. Dry adult sheep were able to utilize the sorghums and gained liveweight, whereas weaned lambs gained less than 0·05 lb/head/day. Although unweaned lambs showed weight gains approximating 0·20 lb/head/day, this was at the expense of the ewe. *In vitro* determinations indicated that digestibility of these forages is low and limits their usefulness.

Natural Pastures

A pilot study on a natural pasture, set-stocked at 1, 2, 3, and 4 dry sheep per acre (first cross Border Leicester-Merino ewes) since December, 1967, has emphasized the potential of this pasture, and demonstrated the urgent need for intensive studies to determine its place in a feed year plan for this environment. When autumn rainfall has been adequate naturalized medics have contributed substantially. At the heavier stocking rates there were marked changes in botanical composition.

Winter Forages

The naturalized medics can provide useful winter and early spring feed with autumn rain, but autumn rain is unreliable. Thus the local practice of sowing oats on fallowed soil appears to remain desirable. In the late autumn of 1970, grazing experiments were initiated to determine the ability of oats to support lambing ewes during the lambing period (mid-winter to mid-spring). These experiments, to be repeated, are examining the effects of nitrogen application and of sowing-rate on dry-matter production and carrying capacity.

Plot studies have also been initiated to investigate the possible role of oats and barley, sod-seeded into lucerne pastures.

Associated studies on lucerne are concerned with the cultivar Hunter River. Plot experiments over 9 years have shown this cultivar to be superior to all others examined in this environment.

Field and glasshouse experiments to examine the physiology of the lucerne plant in response to management systems are continuing, as are studies on seasonal nitrogen fixation and the response to applied nitrogen.

Studies of root nodule bacteria are concerned with the occurrence and effectiveness of naturalized bacteria in soils of the northwest slopes for annual medics, both naturalized and new introductions.

Persistence of Annual Legumes

Because of the high production by subterranean clover in its initial years, followed by poor persistence, the seed setting and persistence of several annual medics and clovers are under intensive study. That the poor persistence is a result of poor set or survival of seed is suspected. Although the naturalized medics can produce winter and early spring feed in quantity, burr in wool is a sufficiently serious problem to justify attempts to find suitable alternatives.

Pasture Seed Production

Field observations of the commercial seed production potential of a number of summer growing legumes and grasses have commenced. Screening is continuing.

NUTRITION OF LUCERNE

Phosphorus and Sulphur

Nutrient Concentration in Lucerne Tops.—Correlation and regression studies on the relation between nutrient concentration in the lucerne tops and nutrient status were completed. Tentative conclusions drawn last year were more or less confirmed.

Sulphur concentrations accounted for 81 per cent of the variability in per cent yields of the following crops, while phosphorus accounted for 50 per cent. Marginal zone for sulphur was 0·17 to 0·20 per cent, and that for phosphorus was 0·13 to 0·25 per cent. Phosphorus concentrations in specific parts of the lucerne tops were not better correlated with per cent yields than those in the whole tops. However for sulphur, the concentrations in the middle and lower leaves were better correlated with per cent yields than those in the whole tops.

Nutrient Requirements in the Field.—Four more field experiments were done on Research Station soils, and each was harvested 4 times. On 2 sites the response to phosphorus was significant at the first 3 harvests; on the third site, at the first 2 harvests; and on the fourth site, only at the first harvest. As in the previous season, responses tended to become insignificant at later harvests.

Maximum or near maximum responses generally occurred at a phosphorus rate equivalent to 2 cwt superphosphate/acre. Only once did a significant response to sulphur occur in 1 experiment, and this was at a phosphorus rate equivalent to 1 cwt superphosphate/acre.

Nutrient Survey

Nutrient Survey on Wheat Growing Soils.—Omission-type nutrient experiments were done in the glasshouse on 4 soils; *viz.* 2 red podsolics, a grey soil of heavy texture, and a krasnozem.

Red podsolics showed a marked response to $CaCO_3$. On 1 of the soils this was probably associated with manganese toxicity, and iron and molybdenum deficiencies.

The heavy-texture grey soil showed severe sulphur deficiency, and a response to a double application of phosphorus.

The krasnozem responded to the double phosphorus treatment and to $CaCO_3$ addition—possibly due to a pH rise.

This survey is the start of a new project ("Soil Factors Associated with Nutrient Deficiencies in Wheat") sponsored by the Wheat Industry Research Committee of N.S.W.

NUTRITION OF WHITE CLOVER

Phosphorus and Sulphur on Granite Soils

This series of experiments was continued into its fourth season at the 3 sites. Very good moisture conditions were experienced until early March, and the overall yields of dry matter were as high as the previous 3 seasons put together where plots were sampled 5 times. Most plots were sampled 3 or 4 times.

There was still a considerable residual effect from phosphorus applied 4 years previously; the response being 2-fold at 50 lb P_2O_5/acre and 6-fold at 200 lb/acre. However the gross yield from 4 growing seasons was greater from 50 lb P_2O_5/acre applied annually than from 200 lb P_2O_5/acre applied in the first year only. The optimum phosphorus treatment over 4 seasons was 100 lb/acre in the first year, 25 lb/acre in second year, 50 lb/acre in third year, and 50 lb/acre in fourth year.

IRRIGATED AND GRAIN CROPS (OTHER THAN BREEDING)

Verticillium Wilt of Cotton

In the continuing study of the biology of *V. dahliae* in soil, 2 points of particular interest have emerged from experiments on the nature and distribution of the fungus on plant roots.

(a) The soil environment can be so changed as to reduce or even prevent the colonization of plant roots by *V. dahliae*. Available evidence suggests that manipulation of the nutritional status of soils can cause a shift in the biological component that in turn prevents *V. dahliae* from reaching the plant root.

Problems associated with using biological control to protect plants from the fungus are the basis of much of the research programme.

(b) *V. dahliae* exists for an extended period on the surface of plant roots and appears to be particularly vulnerable there to fungicides. Commercial and experimental fungicides are now being screened in a search for chemicals that may prevent *V. dahliae* from colonizing plant roots. This programme represents a radical departure from previous ideas on the value of soil fungicides for control of *Verticillium*-wilt diseases.

Pathology Glasshouse

An air-conditioned glasshouse for plant disease research was completed in 1969 and has been in successful operation for more than 12 months. There are 3 separate compartments, wherein temperatures can be controlled fairly closely. Thus it is possible to experiment with plants in 3 different environments, or to conduct 3 different experiments at once.

NUTRITION OF MAIZE

Iron Pyrites as a Sulphur Fertilizer on an Alkaline Soil

Iron pyrites (FeS_2) was found highly effective as a sulphur fertilizer for corn growing in a sulphur-deficient alkaline black earth soil (pH 8·0–8·5). This mineral is produced in Australia. It could be an alternative to the currently used forms of sulphur fertilizers.

Iron pyrites concentrates (47·1 per cent sulphur), with 50 per cent by weight of particles less than 9 microns diameter, applied at 170 lb/acre (190·5 kg/ha) and at 340 lb/acre (381 kg/ha) significantly increased the dry weights of the tops of mature plants by 1·9 and 2·0 times respectively to sulphur sufficiency level, as produced by 40 lb/sulphur/acre (as sublimed sulphur or as sodium sulphur). FeS_2 of larger mean particle size (14 per cent 9 microns) at 680 lb/acre (726 kg/ha) significantly increased the dry weights of the tops by 1·8 times.

These results raise interesting questions as to how FeS_2 is oxidized to sulphate (or is otherwise solubilized) in alkaline soil. The known FeS_2 oxidizing bacteria (*Thiobacillus ferrooxidans*) require acidity (pH 2·2–4·7) at least in their microenvironments.

WHEAT NUTRITION

Sulphur Nutrition

Sulphur Nutrition, Compared with that of Other Species.—The glasshouse experiment described in last year's report was repeated with sulphur applied over a smaller range (i.e. 0 to 12.4 lb/acre). Similar results were obtained; wheat being most and white clover least sensitive of the 4 species to sulphur deficiency.

Nitrogen applied to the cereal depressed sulphur concentrations where sulphur was very deficient. But where more sulphur was available it increased concentrations in the plant tops. In actively growing plants, sulphur concentrations were the highest in oats; followed by wheat, lucerne, and clover in that order.

The cereals recovered a high proportion of the applied sulphur from the soil, and were more efficient in the usage of absorbed sulphur for dry matter production by the time their grain had reached maturity. It is postulated that the sulphur-deficiency tolerance of cereals in the field is at least partially due to these 2 factors.

Nitrogen

Nitrogen Nutrition of Wheat Following Lucerne Leys.—The preliminary treatments in 1 of the 2 long-term experiments on the Research Station ended in December, 1969. The whole area was fallowed in preparation for continuous wheat cropping. Lucerne yields on the red brown earth were generally higher than in the previous season. On both soils the older the lucerne stand the lower were the yields.

Soil moistures were measured at the end of the preliminary treatments and again at the end of the fallow on the black earth. At 20–30 cm depth, moisture rose from 21 per cent to 27 per cent during the fallow after 3½ years of lucerne. But this was still well below 35 per cent moisture after continuous fallow and continuous wheat growing. There was also a significant increase during the fallow after lucerne, at 50–60 cm depth. But at deeper levels the increases were only very small. Rainfall during the fallow amounted to 9·6 inches. Of this, 5·5 inches fell in January.

The 5 off-Station experiments again failed to show any increase in either vegetative growth or grain yield, following application of fertilizer nitrogen. Two of these experiments were in their third year after lucerne.

Wheat Growth and Yield Physiology

Four varieties (Gamut, Festiguay, Mexico 120 and 8127) were sown with and without superphosphate; on 19th May, 16th June, 1st July, and 20th July.

Because of severe frosts, yields increased sharply with later sowings to 1st July, for all varieties; with little difference in yield between the 1st July and 20th July sowings.

Severity of the frost damage is indicated by the following comparisons of yields of each variety at the 19th May and 1st July sowings respectively:

	Sown 19th May bus./acre	1st July bus./acre
Mexico 120	14	68
Gamut	10	34
8127	39	51
Festiguay	21	37

Mexico 120 outyielded the other varieties at all except the first sowing; with Mexico 8127 superior to Gamut and Festiguay at all sowings. Festiguay outyielded Gamut at the first sowing, but produced similar yields at later sowings.

Crop growth, photosynthetic area, and head area and grain growth data are now being processed.

WHEAT BREEDING

Durum Wheats

"*Duramba*".—The semi-dwarf durum line 2030 was accepted for registration as "Duramba" in February, 1970.

Duramba's outstanding characteristic that makes it superior to the currently recommended Dural is its superior straw strength. This was demonstrated remarkably in 1969 when the very wet spring caused the lodging of Dural and all bread wheat varieties in the northwest. Duramba withstood all stresses and remained standing till harvest in all trials and broad acre seed increase.

Duramba yield is similar to Dural in dry seasons but better under moist conditions. With the wet spring of the 1969–70 season Duramba headed the varieties and new lines in the yield trials.

A commercial mill run on the new wheat confirmed that its milling quality is acceptable to the industry. Duramba has a superior yellow pigment content to Dural.

New Early Maturing Semi-dwarf Durum Lines.—These again gave promise of yields comparable to bread wheats. They appear to have good resistance to weather damage and flag smut, and adult-plant tolerance to stem rust.

Seeding Rates.—A trial at Narrabri to examine seeding rates of from 15 lb/acre to 75 lb/acre in relation to yield of durums showed no significant yield differences for seeding rates.

Time of Sowing.—Investigations as to best time of sowing of durums again indicated early May for late maturing varieties, but late May to early June for the new early-maturing lines.

Grazing Trial.—A grazing trial has been started. This is to examine the grazing potential of Duramba, because farmers have been accustomed to grazing their Dural crops and want to continue to grow Dural because of its dual-purpose value.

Hybrid Wheats

The hybrid wheat breeding programme was supported in part by the Wheat Industry Research Council. It ended officially on 30th June, 1970. This was partly because of the great difficulty of recruiting professional staff for plant breeding, and partly because of shortage of funds.

The material produced, largely in the form of sterile and restorer backcross lines of commercial varieties, has been grown again for final checking and cataloguing before it is distributed to other wheat-breeding organizations.

Bread Wheats

Two new crossbreds (a mid-season type No. 221 and a winter wheat designated 237) were submitted to Uniform Quality Testing. Both received very favourable reports. They are being increased for further testing and possible registration. No. 221 in particular performed excellently in yield trials. It could make an important contribution as a replacement for Festiguay.

A more advanced line (No. 8127/266) again produced conflicting results in quality testing and has been withheld for further evaluation.

The season was not generally favourable for breeding work, due to excessive rain. But good progress was made in baking and milling assessment, and the general quality standard of material in advanced yield trials now appears very high.

A special series of trials was carried out to assess the response of parental lines of varying straw height to different rates of nitrogen.

Breeding for Frost Resistance

Facilities for growth and testing of plants for frost resistance were devoted almost entirely to selection within segregating material from the cross (Afghan 996 x Mexico 120) x (I.R.N. 101 x Cheyenne).

Thirty-six single plants were selected from 5 F4 families which had shown high resistance to freezing under artificial conditions. The progeny of the 36 after summer increase were sown for field testing in April, 1970. Most of them are early maturing. Some flower up to a week earlier than Gamut. The field tests should give a good indication of the potential of the resistance provided by the Afghan wheats under local conditions.

Frost Damage to Developing Grain

Widespread and severe crop losses due to frosts in late September, 1969 focussed attention on the unusual problem of freezing of developing grain. Although there appears little prospect at present of providing resistance to frost at this stage of development, some trials under artificial conditions showed that the typical field symptoms can be readily duplicated in the laboratory. Further experiments will explore the possible range of variability between different types of wheat.

Wheat Frost Injury; Chemical Studies

In a glasshouse experiment, using an air-cooled freezing-clamp to freeze wheat stems, the plants have been grown and frozen and are providing a range of physical growth data and phosphorus and nitrogen data in respect of individual stems and ears.

Studies are being made of the accuracy and applicability of assessing freeze resistance in wheat varieties and hybrids by measuring the leaching out of ninhydrin positive substances—mainly amino acids—made possible by freezing the plant tissue. It has been found with growing internodes that:

(a) small quantities of ninhydrin positive substances leach out of stem segments that have not been subjected to sub-zero temperatures;

(b) freezing results in leaching out of bigger quantities of ninhydrin positive substances, to about 40 micro moles of amino acid equivalent per gram of stem tissue;

(c) bigger quantities (3 to 5 times) of ninhydrin positive substances leach out from the lowest (i.e. the more actively growing portion) than from the highest (i.e. least actively growing portion) of the same internodes; at any one test temperature;

(d) by testing a range of temperatures, suitable temperatures for use with varieties and hybrids of differing freeze-resistance have been established; these are —2·5° C and —4·0° C for the lowest and highest portion of growing internodes, and which leach out about 50 per cent and 40 per cent respectively of the ninhydrin positive substances leached out after deep freeze treatment at —18° C (the standard of comparison);

(e) paper chromatographic separations showed that the same amino acids and other ninhydrin positive substances are leached out of previously frozen stem segments at each of the test temperatures studied (and also at the different stages of growth), and that only their concentrations (as indicated chromatographically and verified accurately chemically) differ for each temperature and stage of growth.

The biochemical reduction by plant material, of tetrazolium triphenyl chloride to formazan (red colour), has been found qualitatively to follow inversely the extent of tissue freeze damage as indicated by the leaching out of ninhydrin positive substances.

THE AUSTRALIAN WHEAT COLLECTION

Accessioning and Seed Increase

In excess of 10,000 lines were harvested in 1969. These were wheats from 13 different collections, from all over Australia. Some 5,500 of them were named cultivars. These have now been checked, both in the field and laboratory, and lines having the same name and not differing in any respect have been bulked. Thus, the 5,500 lines have been accessioned under slightly less than 4,000 entries.

The remaining 4,500 lines comprise crossbreds, groups of material from plant collections, and several smaller groups. All these lines, and some 2,000 durum lines from the World Wheat Collection grown by the Tamworth Station in 1967, have been processed to the point where they can be drawn from if needed. Their formal accessioning is now in progress.

In 1970, about 3,000 lines have been sown. Roughly half of these are a resowing of material, already accessioned, from which an inadequate or unsatisfactory seed sample was obtained. The high proportion of these in the 1969 sowing was due to a combination of factors—frost damage, root rots, stem rust and army worms. The stem rust and army worms were partially controlled, but 1969 was a most unfortunate year wherein to make the biggest sowing the Collection will ever make.

The 1970 sowing has been made under irrigation; more row length has been allowed; and the smaller sowing should make rust control easier. This is important, because this material represents the difficult-to-maintain section of the Collection.

The rest of the material sown this year comprises introduced cultivars that have been quarantined in the previous, a section of Halloran's Afghanistan collection, and some items supplied in such small quantities that a preliminary increase in the glasshouse was needed.

Quarantine

The special quarantine glasshouse, for which money was provided by the Commonwealth Department of Health, is now under construction. It should be ready for use in August, 1970.

Quarantine procedures have continued in a glasshouse loaned by the Tamworth Station. During the 12 months, 19 different groups were introduced from 9 different countries. These totalled almost 400 different lines. Sections of this material were released to 12 different workers. Most of these workers received several groups.

Other Seed Supplied

Although the Collection has not yet settled down to routine operation, 9 different requests for seed other than newly introduced cultivars were met. These involved over 500 cultivars.

Data Processing

Progress has been slow. Firstly it has been necessary to handle the actual wheat, and then to record and index the available information. No start has been made or envisaged for the near future on actual use of automatic data processing (A.D.P.) procedures. But close contact is being maintained with the A.D.P. Section to ensure that every step taken is in keeping with requirements.

Agricultural Research Directorate, Wollongbar Station

The research under this Directorate is done by officers positioned at Wollongbar Agricultural Research Station by various Divisions, etc., of the Department. Accounts of the work are appropriately incorporated elsewhere in this Report of the Department, viz., within the Division of Plant Industry, Division of Animal Industry, Division of Marketing and Agricultural Economics, and the Biological and Chemical Research Institute sections. Only a summary of research progress is provided in the following notes.

For Division of Plant Industry

Pasture Species Work.—Emphasis this year was on detailed evaluation of the more promising species available, rather than on introduction of additional species. The various areas and soil types best suiting individual species were defined.

Plant Nutrition Research.—Work on 5 soil types not previously studied showed deficiencies, in varying degrees: of nitrogen, phosphorus, sulphur, potassium, calcium, and molybdenum. Specific fertilizer needs of several pasture species were further defined.

Plant Nutrition-Animal Production.—A major experiment was started. This is to determine the maintenance fertilizer needs of grass pasture under grazing conditions; to trace the movement of applied plant nutrients through soil, plant, and animal; and to measure cattle production on plots differentially fertilized.

Pasture Establishment.—Investigations continued, to examine further the reasons for failure of some tropical legume sowings. The work has confirmed that seed is killed when soil temperatures are high during the first stage of the germination process.

Pasture Management.—Investigations by means of glasshouse pots, field plots and a grazing trial were started. These are to develop methods for management of tropical grass-legume pastures; methods to maximize production but also to ensure tropical legume persistence (now lacking).

Nitrogen Uptake.—Because of increasing use of nitrogen fertilizer in the region, field experiments were initiated to examine the effect of soil moisture level on plant uptake of this fertilizer.

Oats Investigations.—These showed superiority of several new varieties over existing varieties in this area.

"*Whole-farm Feed-year*" *Projects.*—These continued to show that increased animal production can be had under commercial conditions by applying the results of feed-year research.

Weeds Research.—Research on crofton weed enabled control measures to be refined. Recommendations for control procedures were formulated and issued to farmers for the first time.

A north coast weed problems survey revealed that the farmers regard bracken fern as a most important weed problem in the region.

Pasture Utilization.—Co-operative studies by Division of Plant Industry and Division of Animal Industry were extended. These revealed that:

- nitrogen fertilizer can greatly increase animal production from grass pasture, but a high stocking rate is essential to maximise pasture utilization and animal production;
- on the red basaltic soils, the inclusion of tropical legumes in a grass-legume sward cannot increase animal production as much as does nitrogen fertilizer applied to a pure grass sward;
- different management and utilization methods are needed for grass-legume pasture and for grass-plus nitrogen pasture, to achieve optimum production and pasture persistence on each;
- both pasture systems are improvements over native grass pastures.

For Division of Animal Industry

Four major experiments were concluded satisfactorily. The results have been prepared for publication. Four new major experiments were started.

Pasture Species and Animal Production.—Studies of the effect of quality of pasture species on animal production revealed considerable inherent differences between species in their potential for animal production. The reasons were elucidated to some extent. Attention was given to the development of methods for accurate determination of pasture quality.

Dairy Beef Production.—Experiments showed that calves can be multiple suckled on foster cows successfully; that this method of raising calves offers considerable potential for the economic production of beef from the dairy herd. The post-weaning growth rates of such calves are satisfactory. The post-weaning milk production of the cows is not markedly affected.

Nutrition of the Milking Cow.—Investigations into use of feed supplements by the milking cow were started.

Pig Nutrition.—Research on protein nutrition of the grower pig provided recommendations for formulation of improved rations based on meat meal or meat and bone meal.

A programme to investigate mineral and vitamin nutrition of the grower pig was started.

For Division of Marketing and Agricultural Economics

Optimum Feed-year Programmes.—Economics research was continued, to develop a computer linear-programming model for selection of optimum feed-year programmes; a programme suiting the resources of the respective farm.

Whole-farm Development Programmes.—Studies of the economics of the "whole-farm" research projects were continued, and further highlighted the factors that contribute most to the economic success of farm development programmes.

Supplementary or Alternative Farm Enterprises.—Some of the economics research was concerned with the evaluation of these for a dairying area.

For the Biological and Chemical Research Institute

Entomological Studies.—These concentrated on the ecology and behaviour of *Amnemus* weevil, and improved control measures for this important pasture pest. Some improvements in control measures were effected. Basic information from the ecological and behavioural studies will enable more.

Plant Pathology.—The studies enabled some recommendations for control of vetch diseases.

The cause of "Kikuyu Yellows" in kikuyu grass has not yet been identified, but the work is now at a stage where evaluation of possible control measures has started.

Several fruit diseases were investigated. An aerial control programme for banana leaf diseases was developed.

Chemistry.—Investigations involved further refinement of analytical techniques, and analyses of samples from other research programmes. Chemical changes in soil and plant through application of high rates of nitrogen fertilizer to grass pasture are now being investigated. Unexplained disorders in some animals grazing heavily nitrogen-fertilized pasture prompted this.

ROYAL BOTANIC GARDENS AND NATIONAL HERBARIUM

General and Introductory

HERBARIUM ACCOMMODATION

New South Wales still does not have a modern Herbarium building and in this respect contrasts with the other States. Sketch-plans were prepared in 1966–67 but State funds are not yet available and there has been no progress.

The Department had proposed and the Arts and Historical Committee of the Captain Cook Bi-Centenary Celebrations had recommended that a foundation stone for the proposed new Herbarium be laid by Her Majesty Queen Elizabeth II, commemorating in 1970 the 200th anniversary of the visit of the botanists Sir Joseph Banks and Dr Daniel Solander.

The inadequate working and storage space of the National Herbarium building have been further strained by the appointment of 2 more botanists. There will be added strain on space by the inevitable increase in herbarium specimens through the work of these officers.

CONDITIONS OF THE ROYAL BOTANIC GARDENS AND ALLIED AREAS

Maintenance has been satisfactory. The many improvements included road-renovation, construction of garden-beds and lawns, stone-work, introduction of new species for exhibition, pond-cleaning and landscaping. The areas cover the Royal Botanic Gardens, the Inner Domain (including Government House Grounds where the floral displays and lawns were at their peak during the Royal Visit in March-April, 1970), the Outer Domain (where the 6th World Orchid Congress floral show was held, in a large tent), Centennial Park, including Queens Park (where installation of irrigation has been achieved for the playing fields and horse-riding track, ponds cleared and the adjacent area landscaped), Admiralty House (The Governor-General's Sydney residence), and Mt Tomah (a basalt-capped sandstone area in the Blue Mountains being developed as the cold climate annexe to the Royal Botanic Gardens).

SOME STAFF NOTES

Mr K. Mair, Director and Chief Botanist, retired on 30th June, 1970, after 6 years as Director. He had joined the National Herbarium staff in 1946 as Assistant Botanist following his discharge from the Second A.I.F. where he had been officer-in-charge of Army Farms and latterly forest botanist in New Guinea and Borneo.

Mr Mair will be succeeded by Dr J. S. Beard who for 8 years has been Director of King's Park and Botanic Garden, Perth, Western Australia. Dr Beard, a recognised plant ecologist, has been active in the conservation of vegetation in Western Australia.

An appointee for the position of Assistant Superintendent, Royal Botanic Gardens has been chosen. The position has been vacant for 2 years. Mr B. Dangerfield, Supervisor of Parks and Gardens, Albury, New South Wales will take over the duties early in July, 1970. He is a horticulturist of high repute and has previously held a senior position at the Adelaide Botanic Gardens, South Australia.

Botanist Mr D. J. McGilivray returned in April from his term as Australian Botanical Liaison Officer at the Royal Botanic Gardens, Kew, England. In his 17 months overseas he investigated numerous problems for colleagues in Sydney and in other Australian botanical institutions. His study of Type specimens will be of great value in research on the families Proteaceae, Sapindaceae, and Rubiaceae in particular. In his course of duty Mr McGillivray visited some 20 Herbaria and Botanic Gardens in Britain, Europe, North America, and the Pacific.

Dr Wee-Lek Chew, a noted authority on several plant families, and formerly of the Botanic Gardens, Singapore, joined the staff as a Supernumerary Botanist in April.

Former Botanical Assistant Mr A. N. Rodd took up duty in May as Botanist (Horticulture). Mrs J. Thompson, a former Botanist at the National Herbarium, has returned to the staff as part-time Botanist. She is working on the *Flora of New South Wales* compilation *vice* Mr O. D. Evans. Mr Evans' services have been retained on an honorary basis however, to complete his *Flora* work on the genus *Cyperus*.

The difficulty of maintaining the gardening staff of the Royal Botanic Gardens and allied areas at full strength again limited the results achieved. Losses this year totalled 87 personnel, including 85 resignations.

National Herbarium

BOTANICAL RESEARCH

Publications

"*Contributions from the New South Wales National Herbarium*".—Nos 2 and 3 of Volume 4 were submitted for publication and are at final proof stage.

No. 3 contains 10 research papers, on the following: new algal records; a toxic alga; the family Lemnaceae in New South Wales, a new species of *Viscum;* notes on *Platylobium*, *Bossiaea*, and *Templetonia;* the races of *Isotoma fluviatilis;* the Botany of Cook's First Voyage; chromosome numbers in the Oleaceae; chromosome numbers in *Eleocharis;* and new taxa in *Acacia*.

No. 4 comprises the revision of the large grass genus *Poa*, by former Senior Botanist Dr Joyce Vickery.

"*Flora of New South Wales*".—Preparatory to publication the treatments of the mistletoe families Loranthaceae and Viscaceae have been extensively edited and additional records added. The accounts of two important genera of the Cyperaceae, *Cyperus* and *Eleocharis*, and of certain genera of Papilionaceae, are nearing completion.

Other Publications.—"The Orchids of New South Wales" by H. M. R. Rupp was republished in fascimile, with a new Supplement by D. J. McGillivray bringing up-to-date the nomenclature and records of occurrence.

"A Phytochemical Survey of the Australian species of Acacia", by Mary D. Tindale and D. G. Roux, was published in *Phytochemistry*.

The American journal *Systematic Zoology* has republished "Rainbow's End—the quest for an optimal taxonomy" to bring this review of taxonomic theory to a wider readership. This was the Presidential Address to the Linnean Society of New South Wales, by Deputy Chief Botanist Mr L.A.S. Johnson.

Dr Tindale's contribution on ferns and *Acacia* to the 2nd edition of the "Handbook of the Vascular Plants of the Sydney District and Blue Mountains" by Beadle, Evans, and Carolin was prepared for publication.

An article on "Australian Palms" by A. N. Rodd is in press in the Australian Museum journal "Australian Wild Life".

A paper on a new genus of Celastraceae by D. J. McGillivray, has been accepted for publication in "Kew Bulletin".

Projects Completed or Proceeding

Studies on chemotaxonomy of *Acacia* have continued and are being co-ordinated into a reconsideration of the classification of the genus as a whole. The chemical aspects of this work are in the hands of Dr D. G. Roux of Bloemfontein, South Africa. Revision of the bipinnate-leaved ("Black Wattle") group of *Acacia* was continued to an advanced stage.

Manuscript was prepared towards a publication presenting a new system of classification of *Eucalyptus*, in collaboration with Professor L. D. Pryor of the Australian National University, Canberra.

Cytotaxonomic investigation of Australian species of *Veronica* and *Parahebe* continued. Special attention was given to *Veronica*.

Chromosome studies of Restionaceae were pursued, as part of a large-scale review of the taxonomy and phytogeny of this mainly Australian and South African family.

Revision of Australian species of *Galium* continued, in collaboration with Dr F. Ehrendorfer of Graz, Australia.

Revision continued on *Bossiaea* and other legumes, *Dodonaea*, *Stipa*, Casuarinaceae, Juncaceae, and various Proteaceae and Orchidaceae.

Tremandraceae was the subject of revisionary investigation as part of the *Flora of New South Wales* project.

Monographic studies of Piperaceae and Urticaceae were begun, following the appointment of Dr Wee-Lek Chew.

Seasonal growths of the blue-green alga *Anacystis cyanea* and associated species were further investigated in connection with stock poisoning from farm dams.

Ecological investigation of inter-tidal algae and marine animals at Cape Banks ended and a paper was prepared.

Preliminary work was done towards a survey of the plant communities of New South Wales. A central coast area was selected for the first detailed study.

Compilation of a critical census of native and naturalized vascular plants of New South Wales has begun, with indications of distribution and ecological range for each taxon.

Field Investigations in New South Wales

Ecology studies connected with nature conservation proposals were done on the north coast, the Liverpool Range, and various parts of the central tablelands. Other ecology studies were in the northern half of the western and far western plains, the Snowy Mountains region, basaltic areas of the central coast and tablelands and at Nadgee on the far south coast.

Braidwood and Illabo districts were visited for research on toxic algae, and the ecology of marine algae was studied at Cape Banks, Botany Bay.

Botanists studying particular groups accompanied overseas visitors and collected material in numerous areas. The areas included Port Macquarie, Taree, Allyn River, Seal Rocks, Dungog, lower Hunter River, Coonabarabran, Dubbo, Barrington Tops, New England, Capertee-Rylstone, Shoalhaven River, Wingecarribee, Braidwood, Nerrigundah, Belowra, Kosciusko, Big Badja, and the north western and far western plains.

Interstate Visits

Dr Mary Tindale during a month in Western Australia made extensive collections, especially of *Acacia*, and consulted collections in the Perth Herbarium.

Botanists also visited the Melbourne Herbarium and some areas of Victoria, South Australia, and Queensland near the New South Wales borders.

Dr Barbara Briggs collected extensively while on leave in rarely-visited desert areas of Western Australia as well as in northern parts of that State, and in South Australia and the Northern Territory.

Overseas Visits

Deputy Chief Botanist Mr L. Johnson was the Royal Botanic Gardens and National Herbarium official delegate to the XIth International Botanical Congress in Seattle, U.S.A. and, by invitation, a participant there in a symposium on the future of biosystematics. He also visted various Herbaria and universities in the western United States, Hawaii, Mexico, and New Zealand. He studied plants in the field at these places and made collections in Hawaii and New Zealand.

PLANTS NEWLY RECORDED FOR NEW SOUTH WALES

(Species not native in Australia are indicated by an asterisk)

Acacia latisepala, Torrington; previously known from near Wyberba, Queensland.

**Adonis aestivalis*, Parkes district; a European "Pheasant-eye".

Atriplex macropterocarpa, "Kayrunnera", White cliffs area; previously known from South Australia.

Eucalyptus calycogona, Koraleigh, 40 miles south of Balranald; a mallee species known from Victoria, South Australia, and Western Australia.

Glycine latrobeana, north of Kiandra; previously known only from Victoria and Tasmania.

Indigofera hirsuta, Jackadgery, east of Glen Innes; not previously known south of the Queensland border.

**Lysimachia vulgaris*, Wingecarribee Swamp; "Yellow Loosestrife" or "Garden Loosestrife", native of Europe and Asia.

RARE SPECIES AND EXTENSIONS OF RANGE

Bulbophyllum minutissimum, Iluka; rarely collected.

Cystopteris fragilis, Mt Jagungal, Snowy Mountains; "Brittle Bladder Fern", rarely collected.

Danthonia vickeryi, Barren Grounds Nature Reserve; previously known from Blue Mountains area.

Grevillea kennedyana, Olive Downs; known only from the far northwest of New South Wales, and thought to have been possibly extinct.

**Hypochoeris microcephala* var. *albiflora*, Moree; native of South America, naturalized in Lismore-Grafton area, Camden, and Queensland.

Leucopogon deformis, south of Port Macquarie; previously collected only from Centennial Park, Sydney.

Macrozamia lucida, Halliday's Point, Taree; previously known from Clarence River area northwards.

Pluchea baccharoides, Hungerford; better known from Queensland.

Pterostylis nutans, Warrumbungle Mountains; most westerly record in New South Wales.

Sarcochilus hillii, Bega District; previously collected in Nowra area.

Sarcochilus olivaceus, Bega district; previously collected in Nowra area.

Scleranthus pungens, Mt Hope; known from near Broken Hill, Mootwingee, and also from South Australia.

Tetracheca juncea, Lake Macquarie; once common in parts of Sydney district but largely destroyed by development; also known from Newcastle area.

Zieria minutiflora, Coaldale, north of Grafton; previously recorded from New Italy (near Woodburn) and Queensland.

SIGNIFICANT COLLECTIONS FROM OTHER STATES

Acacia gilesiana, 5 miles south of Maralinga, South Australia; not been recorded since the original collection in 1882 at Mt Eba, South Australia.

Acacia yirrkallensis, Gove, Northern Territory; first record in the National Herbarium.

MISSING SPECIMENS

Discovery that a number of species of the family Stylidiaceae (including some Type specimens) had been unlawfully removed from the Herbarium, and that a similar theft had previously taken place from the Melbourne Herbarium, led to the publication of notes in the *Australian Journal of Science* and *Taxon*. Former regulations governing the use of the Herbarium by visitors were also drawn up and put into effect.

Subsequently, part of the missing material was anonymously returned from an overseas source. Details are to be reported in further notes in the two journals.

BOTANICAL EXCHANGES

Botanical Specimens.—The exchange system with botanical institutions overseas and in Australia was maintained. Some 1,752 specimens were received from 12 overseas institutions; 657 from Lae, New Guinea; and 2,350 from 7 Australian institutions. Some 2,677 specimens were despatched, to 12 overseas and 4 Australian institutions.

Special Collections.—Large collections of *Acacia* wood samples were again sent to Professor D. G. Roux of Bloemfontein, South Africa for chemical analysis as part of joint studies on *Acacia* chemotaxonomy.

Living plants of species collected by Banks and Solander in 1770 were gathered for special exhibitions in London and Sydney.

Seed Exchange.—A new edition of the *Index Seminum*, listing some 320 species whereof the seed is available on exchange, was published for distribution to 450 botanic gardens and similar institutions and interested persons throughout the world.

The Botanical Collector.—He spent 59 days in the field collecting seed and herbarium specimens, for records and exchange; and other plant materials, specifically for research here and elsewhere.

Extended visits were made to these areas: Grafton-Murwillumbah, Muswellbrook-Mudgee, Dubbo-Temora, Cave Creek and Cooleman Plains, Snowy Mountains and Big Badja, the north coast, northern tablelands, northwest, and the central western slopes. Shorter trips covered many localities within 100 miles of Sydney.

BOTANICAL MATERIALS BORROWED OR LOANED OR DONATED

Valuable collections were received from Mr N. Byrnes of Darwin, Mr C. Gittins of Sydney, Mr A. C. Beauglehole of Portland, Victoria, and from the British Museum (Natural History).

Loans for research purposes to 10 overseas and Australian institutions totalled some hundreds of specimens. Sixteen batches of loaned material were received for study by the staff.

PROFESSIONAL VISITS TO THE HERBARIUM

Study Facilities.—Many notable visitors from overseas and from Australian scientific institutions were granted study facilities at the Herbarium, and consulted with the staff. Botanists or the Botanical Collector accompanied some on field trips.

Overseas visitors included: Mr H. Connor, D.S.I.R., Christchurch, New Zealand; Dr W. Stearn, British Museum (Natural History), London; Professor Degelius, Göteborg, Sweden; Dr Kobayasi, National Science Museum, Ueno Park, Japan; Dr Otani, Hokkaido University, Japan; Mr C. Jermy, British Museum (Natural History), London; Miss V. Mann, Royal Botanic Gardens, Kew, England; Dr Francis Fisher of the Citrus Experiment Station, University of Florida, U.S.A.; Mr M. Sands, Royal Botanic Gardens, Kew, England; Mr A. Eddy, British Museum (Natural History), London; Professor I. Wiggins, Stanford University, California, U.S.A.; Dr R. Reitz, Herbario "Barbarosa Rodrigues-Itajai", Santa Catarina, Brazil; Dr J. Stein, University of British Columbia, Vancouver; Professor E. A. Schelpe, Bolus Herbarium, Cape Town, South Africa; Mrs R. Northen, Wyoming, U.S.A.; Dr J. Arditti, California, U.S.A.; Dr J. S. Gilmour, Botanic Garden, Cambridge University, England; Dr A. S. Jacobs, Kingston, Jamaica, West Indies; Professor A. Fernandez-Perez, National University, Bogota, Columbia; Mr and Mrs M. Solano and Mr P. Moreno, Orchid Society of Columbia, South America; Professor R. E. Holttum, Royal Botanic Gardens, Kew, England; Dr A. Moriya, College of Agriculture, Utsunomiya University, Japan; Professor A. Keast accompanied by a group of biology teachers, Canada and U.S.A.; Dr P. Raven and Mrs Raven, Stanford University, California, U.S.A.; Dr R. Ornduff, University of California, Berkeley, California, U.S.A.; Professor M. R. Birdsey, Miami-Dade Junior College, Florida, U.S.A.; Dr B. Severne, Massey University, New Zealand.

Visitors from Australia and New Guinea included: Dr R. D. Hoogland, Australian National University, Canberra; Mr P. O. Coyne, Australian National University, Canberra; Mr N. Hall, Forestry and Timber Bureau, Canberra; Mr P. Scobie, Nadgee Natural Reserve; Mr N. Wace, University of Adelaide, South Australia; Miss E. Canning, Botanic Garden, Canberra; Mr D. Verdon, Botanic Garden, Canverra; Mr J. Williams, University of New England, Armidale; Dr J. S. Beard, King's Park and Botanic Garden, Perth, Western Australia; Mr J. Carrick, State Herbarium of South Australia, Adelaide, proceeding to Kew, England, as Australian Liaison Officer; Mr G. Chippendale, Forest Research Institute, Canberra; Dr Kanis, CSIRO, Canberra; Professor N. C. W. Beadle, University of New England, Armidale; Mr J. Z. Weber, State Herbarium of South Australia, Adelaide; Dr R. Schodde, CSIRO Herbarium, Canberra; Mr L. Gilbert, Armidale Teachers College; Mr B. Maslin, Western Australian Herbarium, Perth; Mr P. Kloot, South Australian Department of Agriculture, Perth; Mr Sutherland, Wagga Agricultural College; Miss H. Aston, National Herbarium, Royal Botanic Gardens, Melbourne; Mr B. Norton, University of New England, Armidale; Professor L. D. Pryor, Australian National University, Canberra; Mr N. Byrnes, Northern Territory Administration, Darwin; Mrs H. Swierczkowska-Reeve, Department of Biogeography, Australian National University, Canberra; Dr W. Curtis, University of Tasmania, Hobart; Mr B. Muir, National Herbarium, Royal Botanic Gardens, Melbourne; Mr A. George, Western Australian Herbarium, Perth; Mrs A. Millar, Botanic Garden, Lae, New Guinea.

MISCELLANEOUS AND SPECIAL SERVICES

Special Services by Staff Members.—Mr L. A. Johnson continued as a Vice-President in the Council of the Linnean Society of New South Wales, and in the Parks and Reserves Scientific Committee advising the Minister for Lands. In connection with this Committee's investigations, botanists visited and reported on north coast, Liverpool Range, and central tablelands areas.

Mr Johnson and Dr Tindale was each appointed, by the XIth International Botanical Congress to nomenclature committees of the International Association of Plant Taxonomists.

Dr Tindale continued as Secretary of the Systematic Botany Committee of ANZAAS. Dr Briggs continued to be a member of the International Organization of Plant Biosystematists, and of the ANZAAS Systematic Botany Committee. Dr Chew continued in the Pacific Science Association's Standing Committee on Pacific Botany.

Sixth World Orchid Conference.—Botanists took part, and discussed taxonomic questions with overseas visitors. Mr Blaxell gave a lecture on "The Orchids of Temperate Eastern Australia'.

Police, Customs, and Excise Activities.—The Police Department and the Commonwealth Department of Customs and Excise were assisted with information and identifications concerning drug plants, prohibited imports, and plant material providing evidence in criminal cases. Court appearances were made.

Lectures, etc.—Lectures, seminars, and talks were provided for various institutions and groups. A very successful series of Taxonomy Seminars was conducted jointly with the Botany Departments of the University of Sydney and University of New South Wales.

HERBARIUM LIBRARY

New material totalled 1,301 items (109 books, 1,022 issues of periodicals, 145 pamphlets, 25 boxes of microfiche cards) and sundry maps and trade publications. Of the total, 325 items were catalogued. Periodical articles indexed totalled 342. Donations, within the new materials total, comprised 24 books and 4 sets of periodicals. Loans from the Library to members of staff totalled 1,191 and to other libraries 229.

Royal Botanic Gardens

The Gardens were maintained in good condition. Seasonal displays in the ground and the glasshouses were outstanding. Unfortunately annuals in some beds near Farm Cove were damaged on the night of the Sydney Harbour Carnival. Improvements included reformation of lawns and planting out of additional species.

Public interest in the Gardens was evidenced by the increasing numbers of people visiting on week-days and at week-ends.

The 6th World Orchid Congress brought many botanists and horticulturalists to view the formidable display of native and exotic species in the grounds.

The New Area at Mt Tomah

No additional funds were available to develop as a Cold Climate Annexe this 78-acre donated area in the Blue Mountains, but a small force employed on a casual basis began clearing the overgrown sections. Capital expenditure to provide fences and working facilities will be needed, to precede a master-plan for the development of the area as the Royal Botanic Garden's cold-climate annexe. The climate will permit growth of a wide range of plant species not exhibitable in Sydney. Also, native vegetation on the basalt and the sandstone sections will be maintained—for future exhibition to the public and for study by botanists. Resident staff will be a need in due course.

Captain Cook Bi-Centenary Celebrations

The Director and Chief Botanist was appointed to several of the committees. Staff were associated with certain phases of the Celebrations. When the Government approved opening portion of the Royal Botanic Gardens skirting Farm Cove for the night of April 29th, 1970, arrangements were made with other Departments and with contractors to fence off the assembly area, and to extend from the Farm Cove roadway the installation of drinking points and toilet facilities. Also routes of access from the City were defined. And an area was made available for a Police Band platform.

Notwithstanding careful prior attention to the protective needs the vast throngs of people in the Lower Gardens around Farm Cove on the night of 29th April caused considerable damage to shrubberies and to the garden beds planted as special displays for the Celebrations period. Many of the younger shrubs will take 2–3 years to recover normal shape and growth.

The experience of the effects of opening the Royal Botanic Gardens at night was salutary.

Improvements Effected

A large area surrounding the administrative offices and extending to the National Herbarium was developed to form a suitable approach for visitors. Land was graded and turfed, over falling ground levels, and a large parking area was sealed. Specimens were planted in the lawn area. Beds bordering three sides of the administrative building, and the bed bordering Mrs Macquarie's Road were planted with species of native shrubs and herbaceous groundcover.

New introductions were planted in the Lower and Middle Garden beds. Lawn areas in the Lower Gardens were developed further.

Glasshouses

Notable floral and foliage plant displays were provided. The orchids exhibited at the time of the 6th International Orchid Congress in September, 1969 were especially notable.

Public Works Department architects produced a plan for a new pyramid-shaped glasshouse to be erected on the grassy knoll west of the depot. This structure will be the first of a 3–4 section complex wherein various types of micro-climate will be simulated and a vast range of species exhibited to advantage. Construction is expected to start soon. Eventually the old-fashioned exhibition glasshouses near the palms will be demolished.

Educational and Extension Activities

At the Royal Easter Show.—The Royal Agricultural Society of N.S.W. requested a special Banks Bi-Centenary horticultural display by the Royal Botanic Gardens in the Horticultural Pavilion at the Royal Easter Show. The landscape designing officers provided a bush-scene depicting native species that were seen and collected by Banks and Solander in 1770 whilst accompanying Captain Cook on the east coast of Australia. The designers combined with this an exhibition of living flowering specimens, of species actually collected at Botany Bay by those botanists.

The display received high commendation from the Royal Agricultural Society and thousands of people who viewed it during the 10 days of the Show.

In the Waratah Spring Festival.—Messrs John Fairfax and Son, The Royal Australian Horticultural Society, and the N.S.W. Nurserymens Association staged an educational exhibit of plant material in the Lower Town Hall in association with the Waratah Spring Festival. The Royal Botanic Gardens by invitation contributed to it a wide range of tropical foliage plants. Layout was guided by the Senior Landscape Designer.

The exhibit received widespread commendation. Officers servicing it were plied with questions on identification and cultivation.

National Rose Society.—The Royal Botanic Gardens Superintendent addressed the Parramatta District Region of the National Rose Society on cultivation and use of roses in public gardens.

Landscape Designing

Assistance to external institutions included inspections and where appropriate, reports and plans affecting: the French's Forest Primary School grounds and playing fields; the Child Welfare Department's institution at Kurri Kurri; the Museum of Applied Arts and Sciences, Ultimo; the Mater Misericordiae Hospital, Forbes; and Victoria Barracks, Paddington.

The Senior Landscape Designer attended in Melbourne the three day Conference of the Australian Institute of Landscape Architects.

Miscellaneous

The Director and Chief Botanist prepared an article for the special (Cook Bi-Centenary Year) April issue of the *Agricultural Gazette of N.S.W.*, on "The Royal Botanic Gardens—Birthplace of the Agriculture and Horticulture of a Continent".

The Superintendent of the Royal Botanic Gardens, Mr W. Watson was elected a Vice-President of the Royal Horticultural Society of N.S.W. in acknowledgement of services to horticulture.

Training and Development of Staff

Courses.—Ten officers undertook various stages of the 3-year Horticulture Certificate Course at the Ryde School of Horticulture. One has completed it. Also, 5 voluntarily continued 3-year Post-certificate Courses; 2 in Park Administration and 3 in Landscape Design. Two others undertook specialized horticultural training for self improvement and/or to fit themselves for higher positions.

National Conference, Interstate.—Centennial Park Superintendent Mr R. Salkeld attended the National Conference of the Australian Institute of Parks and Recreation in Melbourne, 13th to 17th October, 1969. He also visited relevant institutions and participated in the post-conference 2-day field trip to Geelong and Hepburn Springs. The Royal Botanic Gardens Superintendent also attended for part of the conference.

Overseas Trainees.—Mr Yeung Wai-Kwong successfully completed his second period of 12 months' intensive training. He gained the Horticulture Certificate with creditable results and returned to Hong Kong in February, 1970. The second Hong Kong Fellow, Mr Woo Wing-Kui, successfully completed his scheduled period of 12 months' training. In light of his aptitude and success, the Hong Kong authorities have decided to extend his training for a further twelve months. Thus he too may complete the final stage of technical studies at the Ryde School of Horticulture and participate in other specialized tuition. A third trainee, Mr Wong Wine Yuen, commenced his period of intensive training on 9th February, 1970.

Assistance to Other Departments and Organizations.—Technical guidance in horticultural developmental work and help in assessing and purchasing specialized park maintenance equipment were given to various Government instrumentalities and commercial organizations. Mutually beneficial close liaison continued with horticultural industry groups and other park authorities, for the general good of the community and park-conscious people.

The Domains

General.—The Inner and Outer Domains were satisfactorily maintained. Improvements included further re-seeding and turfing of denuded areas, removal of miscellaneous tree species lacking vigour, and extension of water services for irrigation.

Playing Fields.—Lunchtime winter sporting fixtures, now long-established as a weekday Domain feature, continued. Demand for playing fields has increased. No fewer than 188 rugby league, 216 soccer, and 1,145 basketball matches were played there in the past 12 months.

Special Occasions.—The grassed areas were used also for the special floral exhibition associated with the 6th World Orchid Conference, the annual parade and assembly associated with Australia Day, and Royal Easter Show procession, the Waratah Spring Festival, Apprenticeship Week, Education Week, and various other occasions. The Captain Cook Bi-Centenary Youth Concert in the Domain drew some 20,000 persons.

The Domain Lodge.—Restoration of the old stone residence at the Domain entrance near the Registrar-General's Department was completed in conformity with plans prepared by the Government Architect. Landscape treatment will be implemented soon.

Art Gallery Extensions.—Extensions to the Art Gallery are still proceeding, in close liaison with the Royal Botanic Gardens Staff.

Eastern Suburbs Railway.—Tunnelling and other work associated with construction of the Eastern Suburbs Railway have recommenced under contract, following agreement with the Trustees by the Railways Department in relation to land use. Close liaison is being maintained.

Car Parking.—Parking in a large area of the Outer Domain was allowed several times during railway strikes. This severely damaged some of the grassed areas.

Naval Oil Storage Depot.—Modifications and extension of the substation attached to the Naval Oil Storage Depot was completed following agreement with the Commonwealth Department of Works. But restoration of adjacent areas is incomplete.

Government House

Inner Domain gardening staff maintained Government House Grounds. The grounds were at a peak for the Royal visit in March and April. Internal floral decorations were also provided. Ground improvements included realignment of garden beds, reformation and regrassing of certain lawn areas and embankments, resoiling of floral beds, and herbicidal/fertilizer treatment of lawns.

Their Royal Highnesses The Prince of Wales and The Princess Anne on 2nd April, 1970 each planted a 6 ft specimen of River Oak (*Casuarine cunninghamiana*) on the lawn west of Government House, near a *Eucalyptus nicholii* planted by the Duke of Edinburgh in 1954.

Admiralty House

Royal Botanic Gardens staff maintained the grounds of Admiralty House, the Governor-General's residence. Interior floral decorations were provided for this and for Government House, Canberra. The Commonwealth Government reimburses the State.

Some pleasing improvements included removal of superfluous old trees and shrubs, and replanting with new material; reconstruction of stone paths, walls and steps, and the regrading and turfing of embankments.

Centennial Park (including Queens Park)

Development.—The Department secured, besides the funds for regular maintenance, further special funds for restorative and developmental works to continue the policies formulated and operated by the inter-Departmental Centennial Park Supervisory Committee which operated from May, 1964 until June, 1968. The special funds of $40,000 allotted for the year brought to $314,000 the total so expended over the past 6 years.

This year the horse-riding track has been reconstructed, new depot and office buildings have been provided, a number of ponds cleared and low-lying areas built-up and grassed, a wide range of operating plant purchased, part of the iron-and-stone perimeter fence restored, certain roadways renewed, and the first and second sections of a large-scale irrigation scheme for the horse-riding track and playing fields installed.

Maintenance.—Centennial Park and Queens Park were maintained at the high standard typical of the last few years. Floral areas, again a special feature, were commended by the visiting public. The main playing fields were further improved by renovation, topdressing, and fertilizing. When irrigation becomes effective next year the full benefit should be apparent.

Facilities.—New timber seats suitably designed have been installed in Queens Park. Further masonry barbecue pits and litter receptacles have been installed in Centennial Park picnic areas.

Pond Clearance and Landscaping.—Further attention was given to desilting pond No. 10, in the southwest area of Centennial Park. Similar work was done also on Ponds 8 and 9.

The area was cleared of excess growth. The pond was freed of most of the reed. Margins were graded and the general surrounds treated in conformity with the plan for this area to become an arboretum landscape of native plant species.

Sporting Facilities.—Considerable attention was given to the playing areas in Centennial and Queens Park. With large-scale irrigation now installed in Queens Park, and near to completion in Centennial Park, these grounds will become first quality areas. Although there is now a fee system for use of the sporting facilities, the demand for their use has increased. Besides the 20 or more groups and schools that regularly use these areas, some 95 other organizations conducted sport there this year.

Areas of Centennial Park were made available as usual for the Royal Easter Show equestrian dressage events and cross-country trials. They were used also for horse riding by Their Royal Highness The Duke of Edinburgh, The Prince of Wales and The Princess Anne.

Gymkhana Area.—The special area allocated for equestrian and dressage activities became increasingly popular this year, and control became more strict to ensure that the area is only used appropriately.

Vehicular Parking Control.—Illegal parking of vehicles on grassed areas is still a problem. This has been eased in some areas by erection of pipe and chain barriers. In other areas, open parkland where that type of control would clash with the surroundings, kerbing will be extended as funds become available.

General.—Continuing restoration of the Centennial Park iron-picket-and-stone perimeter fence, a further section has been completed. This is from the Govett Street Gates, easterly exit of Parkes Drive, along the southeastern boundary to the Randwick gates and Alison Road junction. The work comprised cleaning down, rust-proofing, and painting of the iron pickets, and cement restoration of damaged stonework.

Resurfacing of the 2½ mile circular pedestrian footway, in the centre of the park and parallel to the Grand Drive, has been completed by contract. This, after some years of disrepair, has renewed its popularity for casual and competition walking.

Miscellaneous.—Effective ranger-control throughout Centennial and Queens Park has been restored, by re-establishment of full ranger-strength. Arrangements for members of the Police Mounted Squad to patrol both areas have also been maintained, giving additional supervision greatly appreciated by the Department of Agriculture.

Installation of concrete drainage in the *Melaleuca quinquenervia* ("Large-leaved Paperbark Tea Tree") plantation bordering the western side of Parkes Drive, from the Oxford Street gates to the Grand Drive, has been followed by regrading the entire area with some 2,000 cubic yards of sand fill and resowing with grass to provide a site for picnickers.

DIVISION OF MARKETING AND AGRICULTURAL ECONOMICS

General

STAFF

Increased Professional Establishment

The Division's professional staff total increased greatly. Eleven new appointments were made, including 2 seconded to Agricultural Colleges as lecturers.

The number of establishment positions increased by 5, although 1 lapsed at the end of June, 1970. One major change in the establishment was the creation of a Special Economist (Commodities) position. The appointee is responsible for research and investigation into the outlook for various farm commodities produced in New South Wales, or commodities for which there are production prospects.

Despite the number of new positions established, there were not enough to absorb all of the trainees and other officers who had completed their training or secondment by early 1970. Three of the graduating trainees had to be appointed on a supernumerary basis.

Effect of Dairy Industry Authority Act on Staffing

The Dairy Industry Authority Act, 1970, operative from July 1, 1970, requires the Division to do, at intervals, cost/income surveys of the dairying industry and investigate the cost of processing milk and of production or manufacture of other dairy products.

The considerable work involved necessitates appointment, initially, of 1 experienced agricultural economist; followed in due course by appointment of additional staff—professional and technical assistants.

The legislation also provides for establishment of a Dairy Industry Prices Tribunal, to consider the results of the Division's surveys and to make recommendations to the Minister for Agriculture on prices to be charged for milk and other dairy products. The Acting Chief of the Division is to be a member of the Tribunal.

Positional Changes

The Chief of the Division, Mr C. J. King, has been absent on sick and recreation leave since early November, 1969. The Deputy Chief, Mr P. C. Druce, has been Acting Chief of the Division since that time.

Other staff re-arrangements include the appointment of the Principal Extension Economist, Dr D. E. Maccallum as Acting Deputy Chief and the appointment of the Senior Economics Research Officer, Gunnedah, Mr J. W. Elston, as Acting Principal Extension Economist.

The position of Principal Research Economist is also occupied on an acting basis, pending return of three officers from study leave or secondment.

Secondments; Study Leave; etc.

At the end of June, 1970, the Division had one Economics Research Officer on secondment to the Australian National University, Canberra. Two others continued on study leave in the United States; both due to return to the Department late in 1971.

Also, at the end of June, 12 officers were candidates for Master's Degrees, three for the Degree of Doctor of Philosophy and 1 for the Diploma in Agricultural Economics. Another is undertaking a qualifying programme leading to a Master of Arts in Education.

The Recruiting Programme

The Division's recruiting programme continues to be based mainly on the University trainee system. At 30th June, 1970, there were 16 such trainees in agricultural economics.

Research

The third in the series of Research Liaison Workshops was held this year. The workshops' objective is to acquaint technical research workers with the contribution that economists can make in the design and interpretation of agricultural experiments—to increase the benefit of the results, to the farming community.

The Division's research programme continued actively, although the prolonged absence of one senior officer and the addition of 10 inexperienced economists greatly restricted the time available to more senior officers for research.

Three major studies were completed and reports have been prepared. Six new projects were commenced.

Details of major projects, classified by subject matter, are as follows:

1. ECONOMICS OF PRODUCTION

(i) *General*

Capital Accumulation Among Beginning Farmers.—This project, designed to yield information on the problems of establishment and capital accumulation of soldier-settler farms, had to be abandoned due to transfer of the officer responsible. The considerable amount of data collected will be useful as a source of input-output data for extension purposes.

Survey of Pasture Problems on North West Slopes.—As mentioned in last year's report, this project has been modified. It is now confined to an examination of the problems of development in the Ashford Shire. Progress has been less than anticipated due to changed duties of the officer concerned but a report is expected shortly.

Enterprise Gross Margins for Northwestern New South Wales.—This study continued. A further 15 farms were surveyed, making a total of 90. Preparation of a *Miscellaneous Bulletin* has been commenced. It will outline gross margins at different yields and prices for some 30 different enterprises as well as outline levels of investment, returns to capital, labour requirements, and management practices.

Economics of Soil Erosion Control.—This project, mentioned in last year's report, has had to be abandoned because of a change of duties of the officers responsible.

Farm Management Accounting in Practice.—The original programme, outlined last year, will be expanded to include a new set of financial records as well as production records; to reconcile the needs of the farmer wishing to have records analyzed by computer and the farmer who wishes to do a similar analysis by hand. Work on the project has progressed. A set of production records has been completed and the first draft of a set of financial records prepared.

The Costs of Galvanised Burr.—This project has been initiated to estimate the effects of galvanised burr on farmers' incomes and to ascertain the costs of control or eradication. Data will be collected from available statistics, from a postal survey and from interviews with farmers. Preliminary data have been collected.

Structure of Farms in Lower Hunter.—This study is designed to provide an analysis of current trends in the structure of farm business in the Lower Hunter, and of the relative importance of different socio-economic forces on farm adjustment. Data have been obtained from a sample of 119 farms and are now being analyzed.

(ii) *Dairy Farming*

Whole Farm Studies; Far North Coast.—Recording and analysis of farm management data are being continued on 5 of the original 8 whole-farm research projects on the far north coast. Results of the terminated projects on the 3 basaltic soil farms have been published as *Miscellaneous Bulletin* No. 11.

Results to date on the 5 remaining farms showed reductions in net farm income in 1968–69 due to adverse seasonal conditions. In 1969–70, production was below the 1967–68 peak levels on 3 farms, slightly higher on one farm, and significantly higher on the fifth. Net farm incomes are expected to show a similar pattern.

Optimum Feed-Year Programmes; North Coast Dairy Farms.—A linear programming model has been developed to determine optimum grazing systems on north coast dairy farms under a range of resource conditions—pasture and forage crop species, fertilizer programmes, fodder conservation techniques and deferred grazing patterns. Using the model, farm plans have been generated and the effect—on farm plans—of changes in the availability of resources can now be examined. The study is proceeding to investigate these effects.

Farm Development Plans; North Coast Dairy Farms.—Progress of this project is dependent on completion of the immediate forementioned project. In view of the initial results from the feed-year planning model, the concept of this project will need to be reviewed if it is to be carried out in its present form.

Factors Impeding Adjustment on Far North Coast Low Income Farms.—This project involves firstly an examination of all available data, to measure the adjustments occurring in resource use and returns.

Secondly, an examination of the criteria which have previously been applied to the adjustment process and the conclusions reached from such studies on the north coast has been required. Accurate definition of the problems and the criteria were necessary so that the broad direction in which adjustment was required could be determined.

To meet that objective it was necessary, thirdly, to examine the macro-economic forces creating the problems and causing the need for adjustment. Finally, the project involves a study of the process whereby farming structure changes. The complex of factors, many non-economic, which influence this process preclude simple solutions to the industry's problems.

Evaluation of Farm Feed-Year Assistance Scheme, Far North Coast.—This is an evaluation of the farm feed-year assistance which has operated on the north coast since 1966. The results show that sales of fertilizer have more than doubled since the inception of the scheme. But a sub-sample of participating farms in the Alstonville district shows no increase in actual butterfat production as a result of participation in the scheme. The adverse seasonal conditions over the period and/or the lack of appropriate resource adjustments to take proper advantage of increased fertilizer usage may be the explanation. General applicability of the results is to be further investigated.

Economics of the Mastitis Control Programme (M.C.P.).—The M.C.P., implementing mastitis control demonstration on about 35 dairy farms, is now in its second year for most of the farms. Results being collected will allow *inter alia* an economic assessment of control procedures and their effect.

Drought- and Supplementary-Feeding of Dairy Cattle.—As forcast in last year's report, one paper providing basic data and decision-models for far south coast dairy farmers has been prepared.

It now remains to relate the "best" strategy to the individual farmer's situation, having regard to his preference scale for income in relation to risk assumption. This will take the form of payoff tables relating possible gains and losses to the probability of their occurrence. From these a decision could be made, taking account of attitudes to risk. A draft paper of this second stage is nearing completion.

Costs and Returns from Installation of Bulk Milk Vats.—This project involved the calculation of direct costs and returns to farmers, of installing and operating bulk milk vats under a range of farm conditions and production levels. Data were collected by a mail survey of 30 farms and from interviews with suppliers. The data were used to prepare budgets for a range of farm situations.

The conclusion from the study is that the immediate result of the change from cream and pigs to chilled milk, with and without the pig activity, will, typically, result in a drop in net farm income. But the ultimate effect on income will depend on the farmer's willingness to divert to other productive activity the labour saved by the change. The results have been published in detail as *Miscellaneous Bulletin* No. 10.

(iii) *Irrigation*

Richmond Valley Pilot Irrigation Projects.—This evaluation of the economics of irrigation on dairy farms in the Richmond Valley continues. Records have been obtained since 1965, and the report mentioned in the 1968–69 annual report has been extended to cover 1968–69 results.

Alternative Farm Enterprises with Irrigation; Darling River System.—This study is designed to provide planning data for private irrigation development in the Darling River system. Preliminary budgets, already prepared, will be incorporated in a handbook for extension officers. Publication of this handbook is expected during 1970.

Economics of Flood Mitigation; Lower Hunter.—Attention in this project is still being given to overcoming the difficulties in developing a suitable assessment model for computer application. It is expected that a feasible programme will be available shortly when data processing will be undertaken.

Demand for Water in Cotton Production.—A draft paper on the results of this investigation of the problems involved in pricing public water supplies has been prepared. Some empirical results remain to be finalized. A final report is expected during the coming year.

Income Uncertainty of Vegetable Production.—The objectives have broadened since last year's report and comprise: preparation of enterprise budgets for alternative irrigation enterprises at Mudgee; determination of farm income under various enterprise combinations; and a quadratic programming study of likely variability of income from price and yield variation. The enterprise budgets have been prepared and the programming analysis is being developed.

Coleambally Irrigation Area Cost-Benefit Study.—An assessment of the likely national and regional benefits of future development of the Coleambally Irrigation Area is the purpose of this project.

Alternatives in the organization and development of farms in the area as a whole are to be investigated. Complete data for the horticultural farms have been obtained and collection of data for large area farms commenced. The linear programming results mentioned in last year's report are being revised to take account of recent changes in the economic outlook.

(iv) *Horticulture*

Prune Industry Study.—This study has been completed. A report has been prepared. It includes data on the whole farm financial framework, an analysis of gross margins, and the effects of irrigation and alternative forms of production for the Young district. This report will eventually be published as 2 *Miscellaneous Bulletins* and a *Farm Planning Leaflet*.

(v) *Beef*

Beef Cattle Industry; Especially in Northern New South Wales.—This project, referred to in last year's report, is now concerned with the possibilities for building up cattle numbers during a pasture improvement programme in the Clarence Valley. Some delays have occurred in the programming analysis, due to technical difficulties in computing.

Decision Making by Beef Producers; Clarence Valley.—Further investigations in this study have resulted in concentration on a particular aspect of decision making: spatial diversification (the purchase of additional land in other areas).

A survey forecast in last year's report was done to discover the reasons why land was bought, what use was to be made of it, and the success or otherwise of the venture. The implications of the survey are now being examined.

(vi) *Mutton and Lamb*

Regional Studies of Mutton and Lamb Production.—This is a continuing study financed by the Australian Meat Research Committee. Initially, a short study has been undertaken to assess the impact of the Australian Meat Board's promotion campaigns for lamb. That study is nearing completion.

Work has started on a longer-term project to develop a supply model; firstly to forecast lamb supplies and ultimately to intergrate it with a demand model to forecast lamb prices.

(vii) *Poultry*

Chicken Meat Production in New South Wales.—Incorporating the financial results of the survey, the *Miscellaneous Bulletin* in preparation at the time of last year's annual report has been completed.

Examination of the factors affecting profitability in the industry, derived from survey data, was undertaken this year. It was found impossible to make reliable estimates of these factors, due to extreme variability of the data. The project is being terminated.

2. MARKETING AND POLICY RESEARCH

(i) *Commodity Investigations*

This involves investigation of the current position, trends, and prospects of commodities being produced in New South Wales. So far the production trends for vegetable oils and the market prospects for lupins, rape, soybeans, and safflower have been invistigated. The next commodity group to be investigated is coarse grains.

(ii) *Decision-Making Information in the Marketing System*

This study mentioned in last year's report has progressed. Most of the methodological problems have been explored. It remains to test the actual decision-processes of farmers in practice. From this may be ascertained how information might better be presented to farmers.

(iii) *Study of the "Cobweb Cycle"*

This project was designed to extend current models of cyclical price movements. It is at the testing stage. The methodological problems have been defined and a computer programme has been selected. Generation of data to test the model is being considered.

(iv) *Domestic Demand Structure for Shell Eggs*

Work on this study has been resumed. Several attempts have already been made to estimate a reliable demand function. But lack of reliable data on backyard production has so far precluded a successful estimate.

Advisory, Educational, and Extension Activities

PUBLICATIONS

The Review of Marketing and Agricultural Economics

The journal, acknowledged as 1 of the 2 leading professional journals of agricultural economics in Australia, appeared quarterly as usual. The June, 1970 issue contained a second, commissioned review paper: "Growth of the Agricultural Firm: Problems and Theories"; contributed by Professor Ulf Renborg, an eminent Swedish economist.

Further major review papers by agricultural economists of high professional standing are in preparation for future issues of the *Review.*

Bulletin and Leaflet Series

Miscellaneous Bulletin Series.—Five such bulletins were issued this year. A sixth was being processed at the close of the year, and copy for 2 more were in hand. The series is proving increasingly useful as outlet for research reports that are too comprehensive or detailed to appear in professional journals.

Farm Planning Leaflet Series.—Initiated to assist *Regional* Economics Research Officers to disseminate information for use by farmers and their advisors, this series has been continued—with improved format and presentation. Three issues were published this year.

Agricultural Gazette of New South Wales.—Divisional authors contributed 3 articles to the Gazette this year. With the recent increase in number of economists located in Regions the rate of contributions will increase.

Miscellaneous Periodicals

Production and Marketing Booklets.—Publication of these popular annual booklets continued. As usual, booklets were released on the production and marketing of fruit, vegetables, beef cattle, and sheep.

EXTENSION SERVICES IN FARM MANAGEMENT

With location of 11 more Economics Research Officers in Regions this year, emphasis on an extension function increased substantially. At 30th June, 1970, 16 Economics Research Officers were located among 8 of the 9 Regional headquarters. Mid-Western is now the only Region without an Economics Research Officer at its headquarters.

The demand to deliver talks and lectures by Economics Research Officers to farmer groups still exceeds the handling-capacity of the staff. Officers of the Division provided more than 150 separate lectures to farmer groups this year. Many other lectures were provided for in-service schools and conferences.

The Division provided three 1-week residential schools in Farm Management Economics; 2 for farmers and 1 for Departmental officers.

Fifty radio broadcasts and 5 television contributions were made by officers located in Regions, and numerous articles were written by them to appear in country and metropolitan newspapers, other extension-media journals, pamphlets, and newsletter publications.

The substantial increase in Regional appointments has further broadened the service available to the public, through capacity to provide requested advice on specific and localized farm management problems. Also, the depth and range of liaison with field officers of other Divisions has increased. Thus the economists are influencing and assisting the other officers to put increased emphasis on the economic aspects of their extension programmes.

The Division has embarked on a new education project; groups known as *Educational Farm Management Groups* have been formed in 4 areas. The economists will be attempting to establish in their group members a basic problem-solving approach to management of their farms.

The *Group Records Analysis Scheme* begun last year has developed into a large scale investigation. With the help of country-based Economics Research Officers, many District Officers have formed and are forming farmer groups for records analysis.

The computer services of the Agricultural Business Research Institute at the University of New England, Armidale, New South Wales are being utilized to provide the farmers in each Group with detailed analysis of their farm activities.

As well as benefiting the participating farmers, these groups are proving of great use to extension officers; by providing substantial but hitherto unavailable information relating to physical and financial performance of livestock, crop, and whole-farm activities in different areas of the State.

COLLEGE LECTURING

The Division again provided lecturers in agricultural economics and farm management, either full-time or part-time, at Hawkesbury, Wagga, and Yanco Agricultural Colleges.

As from the start of the 1970 academic year, Yanco College assumed full responsibility for the lectures; and as from June, 1970, Wagga College provided the full-time lecturer in these subjects. Those developments followed the creation of new lecturing positions at the 2 Colleges.

Part-time assistance is being maintained at Wagga College during 1970, and a seconded officer is currently lecturing at Hawkesbury College pending appointment there of a full-time lecturer in these subjects.

An officer of the Division has lectured on a 3 days a week basis in the Diploma in Rural Extension Course, at Hawkesbury College, since inception of the Course in April, 1970.

POLICY ADVICE

The Division has increasingly participated in the provision of policy advice to the Department and the Minister; particularly concerning the marketing of various agricultural products and the question of marketing or production quotas to control surplus production.

Specifically, the Division has been concerned with marketing and production policy for wheat (wheat marketing quotas), eggs, dairy products, cotton, and tobacco, and with market prospects for alternative enterprises to wheat—especially coarse grains and oilseed crops.

The Division continued to advise on the supply position affecting proposed exports or imports of stock feeds.

The Acting Chief accompanied the Minister and the Director-General to all meetings of the Australian Agricultural Council and the Standing Committee on Agriculture during the past year.

Marketing Boards, Polls, etc.

The Division is responsible for administration of the Marketing of Primary Products Act, 1927–65, and in particular for the conduct of producer polls arising from this Act.

The Egg, Lemon, Rice, Tobacco Leaf, Wine Grapes, and Central Coast (N.S.W.) Citrus Marketing Boards, constituted under the Marketing of Primary Products Act, continued to operate and fulfil their statutory obligations.

The Citrus Fruits (excluding Lemons) Marketing Board for the Shire of Wentworth and that portion of Balranald Shire within the County of Taila (constituted in 1966) showed little activity during the past year.

During the past 12 months, the Regulations made under the Act in respect of the Central Coast (N.S.W.) Citrus Marketing Board were promulgated.

A number of Regulations concerning all or some of the other Boards were also amended. These included General Regulations relating to the fees and allowances payable to members of the Boards, and also certain Regulations concerning the Rice Marketing Board. The number of Electoral Districts for the Rice Marketing Board was varied during the year.

Three polls were held under the terms of the Marketing of Primary Products Act. These were:

(a) Triennial Election of 2 Producer Representatives to the Citrus Fruits (excluding Lemons) Marketing Board for the Wentworth Shire and that portion of the Balranald Shire within the County of Taila. (Both candidates were elected unopposed.)

(b) Triennial Election of 5 Producer Representatives to the Central Coast (N.S.W.) Citrus Marketing Board. (All candidates were elected unopposed.)

(c) A poll on the Question of the Constitution of a Potato Marketing Board for the State of New South Wales. (This poll resulted in a negative vote and a Board was not constituted.)

In addition to those polls conducted under the provisions of the Act, the Division conducted the following 2—each at the request of the respective organization:

(a) Triennial Election of 6 State Councillors to the Potato Growers' Association of N.S.W.

(b) Triennial Election of 4 Producer Representatives to the Dried Fruits Board of N.S.W.

The one poll was conducted under the Constitution of the Potato Growers' Association, and the other under the Regulations of the Dried Fruits Act.

Assistance was given to the State Electoral Office in the preparation of a roll of wheatgrowers eligible to vote at the September, 1970 election of 4 producer representatives to the Grain Elevators Board of N.S.W. The State Electoral Commissioner is the Returning Officer for the election.

Marketing Reports and Related Services

Reporting.—The Division fulfilled a statutory function relative to the Marketing of Primary Products Act, 1927–65, by continuing to collect and disseminate detailed wholesale-market information.

Reports covering supplies, quality, price, and price movements, at the City Municipal Markets (fruit, vegetables, poultry, fish, and cut flowers), at Homebush (cattle, sheep, and pigs), at Alexandria, Perry Park, and Sussex Street (grain, forage, and hard vegetables) were provided each day the various markets traded. Retail prices of certain commodities were also reported upon daily.

Press and Radio Daily Service.—Market information provided by the Division was broadcast daily by the Australian Broadcasting Commission including regional relays and interstate hook-ups, and by some commercial radio stations. The daily press, periodicals, Federal and State government departments and instrumentalities, producer organizations, etc., were furnished with detailed marketing information through the *Daily Wholesale Price Quotations.*

Monthly Surveys.—Monthly surveys of wholesale and retail stockfeed prices and wholesale prices of dressed poultry were continued.

Inter- and Intra-State Supply Trends.—Records of selected arrivals into Sydney by rail, air, and sea, of various primary products from inter- and intra-State sources, were maintained.

General Information Service.—Numerous requests were received from State and Federal government departments, banks, and private individuals (in Australia and overseas) for information about prices and prospective markets for an extensive range of primary products.

Crop Reviews and Forecasts.—These services continued. Production forecasts were prepared for wheat, oats, barley, citrus fruits, and broom millet.

The regular monthly survey of *New South Wales Pastoral Conditions* and the *Report on Production Trends* continued to be published. Publication of *Weekly Marketing Notes* continued unchanged.

Representation on Committees

The Chief of the Division continued as New South Wales Government Representative on the Australian Tobacco Board, but the Deputy Chief, as alternate member, has attended Board meetings held since November, 1969. The Deputy Chief has also acted as State agent on the Tobacco Industry Leaf Finance Agency, in place of the Chief of the Division following the latter's illness.

The Deputy Chief (Acting Chief) continued as Executive Officer of the State F.A.O. Committee and as Chairman of the Committee to Examine the Effects of Devaluation on Primary Export Industries. The latter Committee, of which another Economics Research Officer was Executive Officer, completed its investigations in 1970 and made its final report to the Minister for Agriculture for transmission to the Premier.

The Acting Chief has also continued as Chairman of the Advisory Committee for the Diploma in Agricultural Courses—Business and Social Studies and as a member of the Board of Studies. He and another, an Economics Research Officer, acted as members of the N.S.W. Poultry Advisory Board Sub-Committee on Egg Production.

The Acting Chief was appointed Chairman of the Inter-Departmental Committee to Enquire into the Canned Deciduous Fruits Industry. An Economics Research Officer is Executive Officer to the Committee.

The Acting Chief has also been appointed a member of the Dairy Industry Prices Tribunal. This is to commence operations as from July 1, 1970.

He was also the Departmental representative on the State Development Co-ordinating Committee and represented the Chief on the Markets Joint Sub-Committee of the Illawarra Regional Development Committee.

The Special Economist (Crop Forecasting) is a member of the Inter-Departmental Committee on Coarse Grains, and Chairman of the N.S.W. Wheat Forecasting Committee. Other Economics Research Officers acted on various intra-Departmental and intra-Divisional Committees.

International Training Course in Agricultural Marketing

From May 25 to June 26, 1970, the Division, at the request of the Commonwealth Department of External Affairs, organized and conducted the New South Wales sector of a training course in agricultural marketing which had been arranged for 23 Colombo Plan students. The New South Wales section of the Course included many visits to marketing boards and other institutions and processors.

This type of course for overseas people is a complete change from earlier procedure whereby Colombo Plan students arrived singly or in small groups and each was given individual training and assistance. The initial course imposed strain on the Division's limited staff with specialized knowledge of marketing, but ultimately the new procedure will cut down duplication of efforts and ease the pressure on staff. Another Course is projected for early 1971 but not with the intention of consolidating a regular annual interval.

DIVISION OF INFORMATION SERVICES

Functions

The Division provides:

- Editing Services.
- Research Liaison (Science Writing) Services.
- Library Services.
- Enquiry Counter and Publications Distribution Services.
- Home Gardens Advisory Services (by secondment from Division of Plant Industry).
- Assistance in Extension Principles/Methods study courses.

A Special Development

PUBLICATIONS ADVISORY COMMITTEE

The former Editorial Advisory Committee of the Department has been re-constituted as "The Publications Advisory Committee" (P.A.C.), with Terms of Reference as follow:

(1) The Publications Advisory Committee may be concerned in an advisory capacity with any of the Department's publications, wherever edited or produced; their type, purpose, range, quality, and effectiveness; the factors, problems, needs affecting or likely to affect the publications or publication effort; and may encompass also the contributions or potential contributions of the Department's personnel to external publications.

(2) The Committee may receive from any quarter, or initiate, thoughts, ideas, suggestions for discussion that may lead to formulation of advice or policy.

(3) The Committee's advice may be channelled directly to any unit of the Department or to the Permanent Head.

(4) The Committee shall understand that a recipient of Committee advice is not obliged to put the advice into practice wholly or in part.

(5) Where circumstances appear to warrant a directive or a policy decision, the Committee shall have the responsibility to counsel the Permanent Head in respect of these circumstances.

(6) The Committee may function as a reference point, clearing house or place of appeal for any unit or officer of the Department needing help in respect of a decision on where and how material might best be published.

(7) The Committee shall be consulted, as notified business, by any unit of the Department proposing to initiate a trend or line or type of publication, e.g. a new series, or a new periodical. And action shall not proceed until the Committee's views, if at variance with those of the initiating party, have been considered by the Permanent Head.

(8) On each member of the Committee there shall be an obligation to stimulate, particularly within the part of the Department he/she represents, fellow officers' interests in and efforts towards improved flow/quality/effectiveness of material for publication.

As implied by the Terms of Reference and its name the P.A.C. is concerned with *all* publications produced or sustained by the Department, whatever may be the Division or Region or decentralized Institution functioning as production point. The former Editorial Advisory Committee tended to be concerned only with advice to the formal Editing Section of the Division of Information Services.

Members of the inaugural P.A.C. are: Mr J. A. Healey, Principal Veterinary Officer (Extension); Mr R. J. Jessup, Assistant Principal Agronomist (Research); Mr L. G. Boutcher, Assistant Principal Dairy Officer (Extension); Mr E. C. Connor, Principal Fruit Officer (Extension) (alternate—Mr J. K. Long, Principal Fruit Officer, Research); Dr L. R. Fraser, Chief Biologist (alternate—Dr G. J. Shanahan, Deputy Chief Entomologist); Mr D. J. S. Boyce, Assistant Principal Extension Officer (Group Extension); Dr D. E. Maccallum, Principal Extension Economist; Mr P. J. Holligan, Agricultural Engineer; Mr K. Hutton, Research Co-ordinator; Mr W. R. Turner, Editor of Publications; Mr H. Parry Brown (Chairman and Convenor), Chief, Division of Information Services; Miss M. Taylor (Recording Secretary), Division of Information Services.

The 1st and 2nd Meetings have been held. The Minutes are distributed to some 70 intra-Departmental addresses, to help keep all parts of the Department informed of the matters under P.A.C. attention.

Currently a 'Register of Publications' is being compiled. A questionnaire to all publications production-points is leading to the collation of considerable information intended to help the P.A.C. to formulate a programme of long- and short-term goals for development and best use of the Department's publication-production resources.

Sectional Reports

EDITING SECTION

Advisory Bulletins

There are now 1,334 numbered bulletins in the range; 29 less than a year ago. Seventy-five were deleted, most of these because of excessive delay in revision-attention by authors. Forty-six new titles entered the range.

Jobs to the Printer totalled 161, excluding stationary and comparable, miscellaneous items; 128 were numbered bulletins. In the previous year 173 jobs went to the printery, and the average of 10 years has been 235 per year.

The printery delivered 143 (112 bulletins and 31 items comprising annual reports, programmes, prospecti and similar printing, excluding stationary), as against 200 in the previous year and 269 2 years back. At 30th June, 1970 there were 96 jobs at the printery as against 71 a year earlier.

Some 290 publications are in need of reproduction after revision. Of these, 69 have been revised (by authors) but await editing attention; 111 are with authors for revision; and 110 have been held in the editing section though needing author attention. Author-revision of the latter at this time would be premature, according to the author Divisions' priority listings. A year earlier the respective figures were: 323 needed reproduction, including 58 that had been revised and awaited editing, 158 with authors for revision, and 107 held in the editing section for later submission to authors for revision.

Press Releases

As against 90 in the previous year and 59 two years ago, 101 releases passed through the editing section. The majority were Ministerial or Director-General releases.

Miscellaneous Periodicals

Dairy Topics (*bi-monthly*).—Six issues were delivered, including one from the previous year. The latest was the March/April 1970 issue. May/June issue was overdue at 30th June, as was so a year earlier.

The six issues averaged 20·7 pages (23 in the previous year) and six (8·6) articles per issue. Of the 36 articles in the six issues, 21 originated in Division of Dairying, one in Division of Animal Industry, one in Division of Information Services, five in Division of Plant Industry, one in the Biological and Chemical Research Institute and seven from other Departments.

Size will henceforth be 'standardized' at *either* 16 or 32 pages. The less economical intermediate sizes, 20 or 24 pages, will be avoided. This will yield a saving in the per-page cost of Dairy Topics over a year's issues.

Circulation has been reduced to 10,500 by a culling of the mailing list (by Division of Dairying); reflecting the decreasing number of dairy farms in recent years. A few years ago a printing of 18,000 copies was normal.

Poultry Notes (*quarterly*).—Four issues were delivered. The latest was the April 1970 issue. The four issues averaged 22 pages, and 4·7 articles. Plans are in hand to 'standardize' the size at 16 or 32 pages; to exclude intermediate sizes such as 20 or 24 or 28 pages.

Circulation is roundly 4,500 per issue.

Veterinary Notes (*quarterly*).—Three issues were delivered. The fourth was overdue at 30th June. The issues averaged 37·5 pages. Current circulation is 460 copies. Veterinary Notes is a small-offset publication for restricted distribution—controlled by Division of Animal Industry.

The Agricultural Gazette of N.S.W. (*monthly*)

Eleven issues were delivered. The latest was the May 1970 issue. June issue was overdue at 30th June. Only three of the 11 issues occurred in the correct, nominal month; as against 10 in the previous year. Unfortunately the May issue was not delivered until 25th June, 1970, as against the scheduled 15th May date.

The April 1970 issue was a special, of 80 pages. It was linked with Cook Bi-centenary Year activities and reviewed the development of major land industries. It was well received, especially for the early photos it featured.

Revised leaflet material to a total of 47 pages was used in this year's Gazettes, for 'filler' purposes; as against 59 such pages in 1968/9. But four issues were of less than the scheduled 64 pages; one of the four was of 56, and three were of 48 pages.

The *Farm Home Section* averaged five pages per issue, over the 11 issues delivered. Of the total 55 pages, only 2·3 came from the Division of Extension Services, Women's Extension Service.

The *Research Section* averaged 5·2 pages, over 10 of the issues delivered (the special April issue did not include a Research Section). For the previous four years the average was seven pages per issue. The reduction to 5·2 pages reflects a policy now of discouraging submission of science articles, and only one such paper appeared in the Section this year—as against seven in 1968–9, ten in 1967–8, and nine in 1966–7. On the other hand, the policy is to encourage submission of *extension articles about research*, for the general body of the Gazette.

Research Pars averaged 5·3 per issue—as against 4·5 in 1968–9, 3·7 in 1967–8 and 3·8 in 1966–7.

The Agricultural Gazette mailing list and other needs currently require a printing of 26,650 per issue, as compared to 25,000 a year earlier. Additions and deletions to the mailing list gave rise to a net increase of 1,824 addresses; compared to 2,253 in 1968–9, 3,017 in 1967–8, and 1,992 in 1966–7. By Divisional decision the number of spare Gazettes delivered to the Department has been cut to 750 per issue.

Starting with the July 1970 Gazette the standard size will be 48 pages, but with an acceptable reduction of type-size so that the 48 will accommodate as much as was previously on 56 pages. There will be economies at the printery as well as a saving of time often invested by the Division previously in securing 'filler' material aimed at meeting the space of 64 pages.

Text Books/Farmer Handbooks

"Pastures" Book (*J. N. Whittet*).—The 2nd Edition (10,000 copies; $4.20) came into stock in April 1970.

RESEARCH LIAISON (SCIENCE WRITING) SERVICE

In preceding notes, about the *Agricultural Gazette of N.S.W.*, there is a quantitative account of research *Pars* and science articles published in the Gazette: in effect—53 *Pars* in the 10 effective issues.

Only one science paper was published in the Gazette's Research Section. Research workers were actively encouraged, and assisted where needed, to find more suitable means of publishing science papers. The Gazette's need is of articles *about* research, in a form suiting this extension journal—without the painstaking detail of experimental methods, overburden of tabulated data and proof of validity and statistical analyses required in science journals.

Of five science papers initially submitted for the Gazette Research Section—one was sent to an external science journal, two were re-written in extension form and published in the general body of the Gazette, and two have been prepared as Department of Agriculture *Science Bulletins.* The two latter, now at the Government Printery, are the first *Science Bulletin* numbers since No. 79 in 1968.

The two Research Liaison Officers studied and commented on 83 science papers drafted by officers of the Department; 56 of these were under the attention, specifically, of the Research Liaison Officer (resigned 30th April, 1970) stationed at the Biological and Chemical Research Institute, Rydalmere.

Visits to nine Research Stations/Institutes of the Department were made by the head office Research Liaison Officer, to secure "copy" for research *Pars* and/or discuss publication of research material.

ENQUIRY COUNTER AND PUBLICATIONS DISTRIBUTION SECTION

Enquiries Serviced.—Excluding the Home Gardens Officers' work reported in later paragraphs, the Enquiry Counter office assistants (two) handled 29,469 requests—some 7,000 fewer than in the preceding year.

In the 29,469 there were 13,341 in-person enquiries (16,298 in the preceding year); 9,381 'phoned enquiries (12,021) and 6,747 by post (8,206). Of the 6,747 postals, 1,788 were urban and 4,959 were rural—as against 2,499 and 5,707, respectively, in the previous year.

Publications Distribution.—The Enquiry Counter office assistants, and the clerical assistant, distributed 618,199 items of literature (754,562 in 1968–69). In the 618,199 were 93,751 direct to the public; 475,837 in bulk-parcelled responses to Regional/District offices and the Colleges; and 48,611 in applying the "New/Revised/Reprinteds" mailing list—to inform country offices in respect of material recently received from the printery and/or to satisfy the libraries of various institutions in this and other countries.

SALES OF PUBLICATIONS

Revenue from this Division's sales of publications approximated $6,610. It was $9,622 in 1968–69 and $2,362 in 1967–68.

Of the $6,610, the "Weeds" book (2nd Edition) accounted for $2,869, the "Pastures" book (2nd Edition) $1,657, the Farm Record Books $850, and miscellaneous items $1,234.

The 855 copies of "Weeds" sold this year brought to 3,226 the total sold since the 2nd Edition (4,965 copies) came into stock in November, 1968. Various rates of discount, on the retail price of $4.20, applied to 652 of the 855 copies sold this year.

"Pastures" (2nd Edition, 10,000 copies) became available on 28th April, 1970 and 510 copies have been sold; 453 of these at various rates of discount on the retail price of $4.20. A further 364 copies have been dispersed to various Regional Headquarters as sales stock. The bulk of the edition is temporarily still in security storage at the Government Printery, awaiting solution of the problem of more permanent storage by the Division.

HOME GARDENS ADVISORY SERVICE

Individual Contacts.—Concerned with home garden, allied, and commercial floricultural enquiries, of the type that office assistants in the Enquiry Section would be unable to service with literature only, the Gardens Enquiry Officers handled 7,635 requests; compared to 8,666 in 1968–9; 5,708 in 1967–8; 6,886 in 1966–7; 5,881 in 1965–6.

In the 1969–70 total of 7,635 were 1,377 in-person contacts, 4,928 by telephone, 1,258 by post, and 72 from field officers.

Since the appointment of a second Home Gardens Officer in February, 1970, the in-person and 'phoned enquiries have been handled without delays.

Lectures and Field Activities.—Five evening lectures (nine in previous year) were given to horticultural societies/garden clubs in metropolitan and urban areas. Two evening lectures in a three-lecture programme on Garden Design have been given to Arcadia-Galston Agricultural Bureau.

Nurseries and gardens in the 'Hills district were visited, for two-way gains. A seed farm at Wyong was visited for advice.

Literature and Radio.—Three articles were prepared for use in the Agricultural Gazette, and six colour transparencies (35 mm) of native plants were provided for colour blocks in the special April 1970 issue. Two 4-minute tape recordings were made for A.B.C. Childrens' Hour use in response to childrens' horticultural/floricultural questions.

LIBRARY SERVICES

General

Central Library Relationship to State Office Block (S.O.B.) Library.—The position of Librarian-in-Charge, Agriculture, is synonymous with that of Librarian-in-Charge (S.O.B.); the latter concerned with library services of 6 Departments—Agriculture, Local Government, Mines, Public Works, Premier's and Treasury. Near to 80 per cent of the funds to which the Librarian-in-Charge (S.O.B.) has access, roundly 80 per cent of the work-force and 80 per cent of the services rendered are for Agriculture.

The Librarian-in-Charge is increasingly pressed by inadequate staffing and, in a submission to the N.S.W. Principal Librarian, asked for Public Service Board inspection of the situation and needs.

Branch Library Visits.—The Librarian-in-Charge visited Hawkesbury and Wagga Agricultural Colleges, each of which, having become a College of Advanced Education, needs additional library staff. She also visited Wollongbar Agricultural Research Station, Wollongbar Cattle Tick Research Station, the District Veterinary Laboratory, Wollongbar, the North Coast Regional Headquarters, Lismore, the Board of Tick Control, Lismore, the Alstonville Tropical Fruits Research Station, the National Herbarium, and the Glenfield Veterinary Research Station. Many times this number of Branch libraries need at least a familiarization visit by the Librarian-in-Charge and, in fact, professional advice and aid. This is another facet of the submission made to the N.S.W. Principal Librarian re staffing. Also, a Library Assistant was loaned for a short period from the central library, respectively to the Wagga and the Yanco Agricultural College, to meet needs there caused by lack of staff.

The libraries of the Divisions of Horticulture and Plant Industry and the Biometrician's Branch were given special attention and have been combined as one Branch library at the Mark Foy building. A submission has been made for staff.

Funds for Books, Periodicals, Papers

The C.R. B4 vote for Department of Agriculture was increased from $15,800 in 1968–9 to $19,024 in 1969–70. The Library also had access to $15,000 from the Commonwealth Extension Services Grant (C.E.S.G.), and the Hawkesbury, Wagga, Yanco, and Tocal Agricultural Colleges provided access to further amounts, aggregating $6,670, from Commonwealth and Student Trust Accounts. Overall, the total of funds was quite inadequate for the needs but, on the other hand, the volume of work in the Ordering Section was barely manageable because of the staff-strength problem.

Orders, Accessions, Loans

Order Statistics.—Some 2,559 new items were ordered or covered by requisitions through local suppliers or the N.S.W. Government Offices, London. Of the total, 686 were for Hawkesbury, 167 for Wagga, 90 for Yanco and 54 for Tocal Agricultural College. In contrast with Agriculture: for other Departments the Library office ordered, against C.R. B4 funds, 159 items for Public Works, 134 for Mines, two for Local Government, and 19 for Premier's Department.

Central Library Accessions.—The total was 28,461 items, compared to 26,974 in 1968–9. The 28,461 comprised 1,589 books, 18,378 new issues of periodicals, 1,126 annuals and 7,368 pamphlets (4,428 in series, 706 catalogued, 548 distributed by subject, and 1,686 miscellaneous). The average per week rate of accessions was 547 items.

Central Library Loans.—Loans totalled 36,448 as against 37,021 in 1968–9. The 36,448 comprised 25,473 periodical issues circulated (average 489 per week) and 10,975 miscellaneous loans (average 211 per week). Of the 10,975 miscellaneous loans, 8,812 were to Departmental officers, 1,395 to libraries of other institutions. Some 768 were borrowed from other libraries. Also, numerous photocopies were supplied or received in lieu of loans.

Branch Libraries' Loans.—Figures are incomplete: progress total 37,148 loans. These comprised 6,006 at Hawkesbury College; 11,701 at and from Glenfield Veterinary Research Station; 484 at the Agricultural Research Institute, Wagga; 1,214 at Wagga Agricultural College; 1,414 at the Royal Botanic Gardens and National Herbarium; and 15,329 at and from the Biological and Chemical Research Institute.

New Exchanges Arranged

Reciprocal literature exchanges were arranged this year with various institutions in the U.S.A., West Bengal, Sao Paola, France, Ethiopia, and The Netherlands; reciprocal for the *Agricultural Gazette of N.S.W.* and/or the *Review of Marketing and Agricultural Economics* and/or the *Annual Report* of the Department of Agriculture.

Other Library Services

Library Information Bulletins.—Eleven were compiled and distributed; totalling 515 pages and 5,328 items; compared to 483 pages and 4,839 items in the 10 issues in 1968–9.

Reference Work and Literature Searches.—Bibliographies produced by literature searches done for officers were regularly listed in the Library Bulletin. This year 45 search lists were collated; 16 fewer than in 1968–9.

Photocopying Service.—The jobs arranged through the S.O.B. Document Reproduction Centre, totalled 1,662 (1,131 a year earlier) and involved 11,681 sheets (10,139).

Translation Service.—Twenty-seven translations were secured for officers; from Dutch, French, German, Italian, Japanese, Russian, Spanish, and Swedish literature.

ASSISTANCE IN EXTENSION SERVICE STUDY COURSES

The Divisional Chief contributed much of the basic first two weeks of the 10 weeks course in Australia for Extension personnel from Afro/Asian/South Pacific countries. This was the third such course organized by Department of External Affairs. He contributed also the lecture courses on Extension Services for undergraduates in the School of Agriculture, University of Sydney.

DIVISION OF EXTENSION SERVICES

Obituary

Following protracted illness, Mr F. J. Nicholson, Regional Supervisor, Mid Western Region, Cowra, died on 19th June, 1970, aged 45.

Mr Nicholson, a former District Agronomist, was appointed to the position of Regional Supervisor, Mid Western Region, when it was inaugurated in 1957. He was a recognized authority on extension principles and procedures and will be sadly missed by his friends and by extension services throughout the State.

Extension Programme Planning

GENERAL

The extension programme planning requirements formally adopted by the Department in 1968 are now entering their third year.

Reports for 1969–70 indicate a more professional approach by officers to programming of extension goals and activities. Two of the main reasons are: the support of and joint experience with colleagues who are also planning, and the constructive encouragement by Regional Supervisors.

There have been some variations of approach and interpretation by Divisions involved in extension programming. These were discussed in February, 1970, at a Conference of Regional Supervisors and the Extension Programming Co-ordination Committee. As a result it was resolved: that a set of guidelines be produced for all officers involved in extension programming, so that more uniform approach would be achieved; and that Divisions prepare, for guidance of their field officers and the Regional Supervisors, situation analyses assessing the various agricultural and livestock industries—these analyses to be updated at least yearly and more often where needed.

These industry situation analyses would help extension officers to define, more accurately, the appropriate extension objectives and attune them with State and National situations and needs.

REPORTS ON EXTENSION PROGRAMMES

Some amendments have been made to the trial-forms produced last year for extension programme reviews and new or amended extension programmes. The new forms are now in pilot use, State-wide. If quite satisfactory, they will be produced in quantity for use in 1970–71.

EXTENSION WORK CALENDARS

In two Regions, extension officers and the Regional "extension specialist" have produced work-calendars. These, setting out in calendar form the work-commitments in respect to each objective in the programme, will if successful be adopted on a State basis.

PROPOSED NATIONAL WORKSHOP ON PROGRAMME DEVELOPMENT

The Standing Committee on Agriculture has approved the holding of a National Workshop on Programme Development. This will examine all aspects of extension programme planning, based on experience so far gained. The workshop is likely to be attended by four to five representatives from each State. It will be held in New South Wales in April, 1971; with the host State responsible for organization.

Extension Research/Evaluation Unit

Creation of this unit was approved in 1968–69. But the officer appointed to organize and control its operations cannot (because of Senior Lectureship commitments in the post-graduate Diploma in Agricultural Extension Course at the University of Melbourne) take over the duties until January, 1971. Two other professional officers are expected to be appointed, to commence duty with the unit at the same time.

Some pre-planning has been done. Thus the unit should become viable almost immediately in January, 1971.

Other Professional Staff Developments

RESEARCH/EXTENSION LIAISON OFFICER, ARMIDALE

Appointment of an officer to a newly established position of Research/Extension Liaison Officer, at Armidale, in the Northern Region, has been approved. The officer will be responsible for liaison between the Department's research and extension workers, appropriate personnel of the Faculties of Rural Science and Agricultural Economics and the Department of University Extension, University of New England, and the CSIRO Pastoral Laboratory at Chiswick. Flow of research trends and results, and of extension needs, between the officers concerned, should improve accordingly.

EXTENSION SPECIALISTS FOR REGIONS

The first of these appointments has been made. The officer, serving the Northern and North-western Regions, has headquarters at Tamworth. Similar appointments have been approved for Lismore (North Coast Region) and Goulburn (South Coast and Tablelands Region).

These officers' five main areas of responsibility are: extension programming, use and co-ordination of resources; extension evaluation; development of voluntary groups as extension agencies, e.g. branches of the Agricultural Bureau; development of extension officers' skills in the methods, channels and equipment of extension; and extension/research liaison.

EXTENSION OFFICERS (GROUP EXTENSION) FOR REGIONS

Two women Extension Officers (Group Extension) have been appointed to Regions. One has headquarters at Lismore, for North Coast Region, and one at Orange, for Western and Mid Western Regions.

Besides assisting the organization of group-extension situations for farmers, they will attend specifically to educational programmes involving the farm family as a unit. These activities will relate in particular to farm and home-management economics, records-keeping and budgeting.

DEVELOPMENT OF OFFICERS IN AND FOR EXTENSION SERVICES

Practical Early Experience

In-service development of "officers-in-training" continued in all Regions. The system gives a young officer a minimum of 6 months intensive training in one or more Regions.

Under the guidance of the Regional Supervisor, the young officer is placed with experienced personnel of other subject-matter Divisions as well as those of his Division. He is given instruction and actual experience in all aspects of extension work and of country office-administration procedures.

Extension Service/Methods Schools

The Division conducted 2 in-service Extension Service/Methods Schools this year. Each was residential and of 10 days' duration. Each was attended by about 40 officers. The schools provided training in extension principles and methods, and human relations.

One of the schools was requested by the Division of Animal Industry, to help cater for the extension training needs of veterinary personnel.

The Division also organized the programme and provided lecturers for a one-week, extension segment of a 14 weeks Sheep and Wool Husbandry Course for Afro-Asian fellows studying in Australia (a Commonwealth Department of External Affairs project).

Also, the Division provided sessions on extension principles and methods for field officers at schools promoted, primarily for other purposes, by various Divisions and Branches of the Department and/or by commercial bodies affecting agriculture.

Regional Workshops

Regional workshops designed to improve officers' skills in extension methods were held in the Northern, Northwestern, and Southwestern Regions. Subjects were "communications", "use of the overhead projector", "radio and television".

Study Tours Overseas

The Chief of Division of Extension Services, Mr B. D. Ament, with senior extension personnel from other States and the Commonwealth Department of Primary Industry, undertook an overseas study tour of extension services in South Africa, The Netherlands, Great Britain, Canada, the United States, and New Zealand. Funds were provided for the tour from the Commonwealth portion of the Commonwealth Extension Services Grant.

Principal Extension Officer Mr J. J. Slater undertook a study tour of extension services and methods involving visits to Italy, Switzerland, West Germany, Denmark, Holland, Great Britain, the United States, and Fiji. His period abroad included a three weeks course on "communications and human relations" at the University of Reading, England.

The Mid Coast and Hunter Regional Supervisor, Mr N. W. Vane, presented a paper in an Extension Seminar at Massey University, New Zealand, and followed this with a three weeks study tour of New Zealand extension services.

Funds for those two cases were from the New South Wales allocation of the Commonwealth Extension Services Grant.

Formal Courses and Miscellaneous

Degree Courses.—Three officers of the Division are continuing formal studies towards the degree of Bachelor of Arts. One officer has been awarded a Wool Board Scholarship (two years) to undertake a M.Sc. course at the University of New South Wales.

Higher Grades Examination.—The Public Service Regulation 126 Higher Grades Examination on "Agricultural Extension", for the Department's field officers and the Rural Youth Organization officers of Department of Education, was set and marked by the Division's Assistant Principal Extension Officer (Group Extension).

Farm Records Analysis Groups

As a pilot venture, co-operative with the Division of Marketing and Agricultural Economics and with the Agricultural Business Research Institute of the University of New England, a limited number of Farm Records Analysis Groups (maximum of two per Region in 1970–71) have been or are being formed. A Group comprises 10 to 25 farmers. Departmental extension officers and Economics Research Officers function as Group co-ordinator. The object is to provide a simple, low-cost system of keeping critical business records, and their analysis in the whole-farm context. The University has developed a computerized system to process farm records.

The Department's Division of Marketing and Agricultural Economics in association with the University of New England initiated the project. A Steering Committee under the Chairmanship of the Chief, Division of Extension Services, was formed during the year to formulate policy and plan the object.

Regional Services

STAFF; NUMERICAL

At 30th June, 1970, within the nine Regions and under Regional Supervisors' administration for advisory, regulatory, and allied services, there were 477 officers of the various subject matter Divisions of the Department—and a further 41 positions were vacant. Thus, the total including the vacant positions would be 518; an increase of 17 by comparison with 12 months earlier.

The Department's personnel at Research Stations and Agricultural Colleges, and the veterinary personnel, are not in that total. They are separately administered systems. But the total of 518 does include 102 officers (four positions vacant) in clerical and office assistance categories.

REGIONAL ADVISORY COMMITTEES

The Advisory Committees, one per Region, appointed by the Minister to be representative of primary industries and areas within the respective Region, continued their role. They offered ideas, recommendations and comment affecting extension and research.

In particular this year, the Minister requested Committees' views on the control of noxious animals, insects, and plants. The Minister attended Advisory Committee meetings in the North Coast, Northern, Mid-Coast and Hunter, and Mid-Western Regions.

MASS AND GROUP MEDIA USAGE

General

Press, radio, and television usage, and purposeful participation with farm organizations in staging formal group activities—schools, courses, seminars, and field days—continued to enhance the Department's extension effectiveness and public image.

The 9 Regions aggregated 2,045 formal publicity releases for press, radio, and television usage; 6,599 radio sessions; 144 television sessions; 140 schools or courses for rural people, and 339 field days. The "2,045 formal publicity releases" does not include the considerable number of multi-page newspaper supplements provided for some of the rural newspapers. Similarly, the many meetings of Agricultural Bureau branches and other farm organizations attended by field officers for talks, discussions, and film or slide screenings are not accounted for in the figures.

Publicity re Plague Locust Campaign, Gilgandra/Coonamble

The Publicity Officer, Western Region, was assigned a special project; to take control of the publicity campaign concerned with outbreak of plague locusts in the central west in November and December, 1969. In this period he was responsible for 17 national press releases, 7 national radio broadcasts (A.B.C. and major networks), 4 television news inserts for the A.B.C., 2 television features for the A.B.C. (one for release in Australia and one, in colour, for release in Britain), and 43 segments for use by commercial television.

Some Particular Notes from Regional Supervisors

MID COAST AND HUNTER REGION

Industry Trends

Dairy Industry.—The continuing adjustment to changing economic circumstances is reflected in part by the decline in dairy farm numbers. Further to the trend of recent years, in 1969–70 the number of suppliers to dairy factories in the Region decreased by 402; slightly in excess of 11 per cent. Notwithstanding the fewer farms, output remains fairly constant—reflecting increase in efficiency of the dairy farmers remaining.

Wine Grapes Industry.—Expansion of wine grape area in this Region has been spectacular. This year 1,365 acres of new vineyards were planted in the Hunter Valley. The total is now 3,552 acres; a record. Appointment of a District Fruit Officer to Maitland in May, 1969, was most timely. He has been able to guide the developments.

Beef Cattle Industry.—This too has expanded. Cattle numbers up by 5 per cent to about 540,000. Two large-scale enterprises involved in the developments are: a projected investment of 8 million dollars by the A.M.P. Society, to develop 40,000 acres of coastal country to carry 12,000 breeders; and the establishment of a feed-lot at Aberdeen, to supply 3,000 prime beef carcasses annually to Japan.

Regional Staff Increase

Two Economics Research Officers were appointed to this Region. Those appointments, together with formation of 2 Farm Records Analysis Groups, provide scope for greater emphasis on farm management economics in the Region.

Extension service for the dairy industry, especially in the Hunter Valley, will be further strengthened by the appointment of a Livestock Officer (Dairy Cattle).

Change in Code of Operations; to Include Gosford and Wyong

An amendment to the Code of Operations of the Mid Coast and Hunter Region will take affect at 1st July, 1970. From that date the Shires of Gosford and Wyong will be within the Region.

MID-WESTERN REGION

Trends in Agricultural Production

Basic to trends in the Region is the attempt by producers to find enterprises alternate or supplementary to wheat and wool.

Most marked is the increase in oilseed crop production, highlighted by this development in the Condobolin Agronomist's District:

	1969 (estimated)	1970 (estimated)
	Acres	Acres
Sunflower	250	3,000
Rape Seed	80	2,700
Safflower	500	10,000
Soy Beans	400	2,000
Linseed (only 500 acres in 1968)	15,000	15,000

Wheat acreage in the Region at the 1970 sowing was 25 per cent down on normal, whilst oat sowings had increased by 10 per cent and barley by 30 per cent. Sheep numbers continued to increase; averaging 6 per cent up for all Shires, except Lachlan Shire—where a slight drop was recorded. Cattle numbers continued to increase, with a general rise of 20 per cent; but a 33 per cent rise in West Wyalong area. Increase in pig numbers also continued.

Pasture seed industry has developed dramatically. Areas of all subterranean clover varieties except Dwalganup increased. An additional 2,400 acres was submitted for certification. Jemalong Barrel medic areas increased by 1,052 acres, to 1,886 acres. And, in this first year of the lucerne seed certification scheme, 12,396 acres of lucerne were submitted. Grass seed production area dropped by 147 acres to 971 acres.

Extension Activities

The changing agricultural situation is being continually assessed. Surveys and needs-assessments through the year provided an effective base for extension activities. Officers have made good use of group methods, associated with more trials and demonstrations. The group work and trials and demonstrations, together with efficient mass media usage, are helping to meet the increased demands for extension officers' services. In respect of individual farm visits: the demand has changed from straightforward technical advice to overall farm management and economic matters, especially those associated with enterprise selection and development.

NORTH COAST REGION

Changes in Land Use

To Beef Raising.—Rate of change from dairy production to beef raising on the north coast continued to accelerate. In the past 3 years the percentage of beef cattle compared to dairy cattle has risen about 12 per cent in the North Coast Region. Almost all dairy farms now use at least one beef breed bull.

From Dairy Industry.—The number of registered dairies continued to drop sharply; 11 per cent lower in 1969. But for some of the dairies remaining the unit size has increased. For example: in Lismore district, dairy herds increased by three cows per dairy in 1968–69 and six cows per dairy in 1969–70. These trends are apparent throughout the Region.

Research/Extension Liaison

Agronomy.—Two, 2-day conferences for agronomy staff including District officers and the research personnel from Wollongbar and Grafton Agricultural Research Stations were held. On the first day of the conferences, Departmental recommendations for the coming sowing seasons were updated in the light of research results and district experience. Also, some short papers on topical subjects were presented and discussed. A field excursion was held on the second day.

It is proposed to broaden these conferences in future; to include Livestock Officers and Economics Research Officers, and to deal with utilization of pastures and crops.

Fruit Industry.—Two horticultural conferences for District Fruit Officers and Fruit Research Officers from Alstonville Tropical Fruit Research Station were held. Fruit Inspectors also were at one of these. These conferences, like the agronomy conferences, also provided one formal day followed by a field excursion day.

NORTHERN REGION

Extension Training

A three-day workshop was conducted at Tamworth, jointly with the North Western Region, for training in the use of extension aids. Particular emphasis was on the overhead projector. Thirty officers and officers-in-training participated. The workshop achieved its objectives inasmuch as officers adopted new attitudes towards and acquired new skills in the use of their overhead projectors.

Assistant Principal Extension Officer Appointed

The appointment of a decentralized "specialist" in extension (with Tamworth as headquarters for his service to the Northern and North Western Regions) was the first in New South Wales and probably in Australia. After initial assessment of the extension situation in the two Regions the officer has so far devoted much of his time to the development of officers' extension programmes. The results are evident in officers' more purposeful plans this year.

A "blue-print" is now being developed for more effective use of resources in farmers schools, and for in-service training (decentralized) in extension principles and methods.

Extension/Research Liaison Position

The recent establishment of a Research/Extension Liaison Officer position, Armidale, has opened the way to closer working relationships in the Region between the Department, the CSIRO, and the University of New England. The officer will be responsible to develop effective liaison between research officers and between extension and research officers.

NORTH WESTERN REGION

Improved Extension Service

Improved extension service in the Warialda and Walgett districts was effected this year. Extension personnel at Moree and Narrabri, respectively, now provide a regular 2-days per month service to Warialda and Walgett. This was initiated in each case by the District Agronomist, supported by the Livestock Officers (Sheep and Wool).

The Shire Council in each case has provided an office and telephone for the visiting extension officers.

Landholders in these districts now have opportunity for regular personal contact with extension staff.

Regional Liaison with Chartered Accountants

Following discussion with some local accountants on the question of farm records, the North West Group of the Australian Society of Chartered Accountants approached the Region to conduct a Workshop for them. The Accountants wished to discuss the type of records needed for farm analysis; also production and cost data for various enterprises. A meeting attended by 50 north-western accountants was held for this purpose. Regional Economics Research Officers addressed them.

As results the accountants seem to have agreed to standardize the type of information they will require from farmers, and their clients will be asked to keep sufficiently adequate records for farm management guidance.

SOUTH COAST AND TABLELANDS REGION

Farm Business Management

Woolgrowers' worsening economic situation has increased their interest in the economic aspects of farm management.

Although it may be shown that even at the current low average price for wool from tablelands areas (35 cents/lb) a reasonable net average profit could be made, this would not be taking into account the heavy indebtedness many graziers are now operating under. This situation has been brought about by drought; by fire, in some areas, as well as drought. Servicing of loans incurred as a result of these crises cannot possibly be met by the returns from wool.

The beef market has provided some relief for those able to increase their beef herds. Also, a few have ventured into cropping (wheat, oilseed crops, and other grains) but the scope for introduction of farming enterprises is limited by topography and soil as much as by markets.

One way to help alleviate this situation is to provide producers with basic knowledge to improve their managerial skills, and sharpen the economic and business acumen. This need could hardly be met by the resources of the private, farm consultants.

The Department's programme of group farm management education (*vide* the Farm Records Analysis Groups), launched this year as a pilot project, will help to meet the need.

Three Newsletters Now

"*Guide for Graziers*".—This monthly newsletter, initiated some 5 years ago at the request of a few graziers on the southern tablelands, now has a mailing list of 500 primary producers who have made a personal request for the publication. The "Guide" contains topical, informally presented articles and notes. Surveys have shown it is greatly appreciated.

This year, Two More Newsletters.—The Region this year initiated: the "Illawarra Newsletter" and the "Far South Coast Newsletter", to serve 1,400 dairy farmers. These newsletters are being distributed through dairy factories. Provision is in hand to extend the distribution also to coastal farmers engaged in non-dairy pursuits.

SOUTHERN REGION

Changes in Farm Incomes and Attitudes

Because of the prevailing difficult situation in respect to markets, farmers' incomes have declined significantly. There are accompanying changes in farmers' requirements from the extension service. Interest in the economic aspects of farm management has strengthened; also in alternate crops to wheat, and in more diversification of enterprise. Meantime, demand for technical advice associated with the older established industries has decreased.

Response to the Department's policy to establish some Farm Records Analysis Groups has been remarkable. For example: 2 meetings to discuss this project, at Tumbarumba and Tarcutta respectively, were attended by 60 and 100 farmers respectively. A Group was formed in each case.

On-Farm Storage of Grain

The large acreage sown to wheat in 1969 and the early promise of good yields made it obvious that there would not be enough Government storage space, and that considerable grain would have to be stored on-farm. An extension programme was instituted, for advice to farmers facing this problem.

Unprecedented orders were received by silo manufacturers in the Region. The number of silos sold represented the capacity of labour and plant available. In 1968–69 some 991 silos had been made and sold by 6 firms. In 1969–70, some 2,167 were made and sold. Besides, many old sheds were satisfactorily converted to grain stores.

SOUTH WESTERN REGION

Mice Plague

Favourable conditions, mild weather, adequate moisture, shelter, and an abundance of food are thought to have caused this year's very rapid mouse-population increase. The problem first came to notice when irrigated, summer crops of grain sorghum and sunflowers were attacked in January, 1970. Damage subsequently occurred in rice and maize crops, and some also in rockmelon, tomato, and peach enterprises. The losses are impossible to calculate, but without doubt the cost of the plague would exceed a million dollars.

Farmers used a range of extremely potent poisons but although millions of mice were killed there was little apparent effect. At the end of June, 1970, in spite of winter conditions, the mice persist in disturbingly large numbers. They now pose a threat to 1970–71 summer crops.

Rice Production Trends

The issue of 300 new rice licences for the 1969–70 season brought to 1,780 the total of rice-growers.

Almost all of the Australian production of ¼ million tons is grown in the South Western Region, but a small number of Queensland farmers in the Burdekin district have grown long-grained rice successfully and, by selling on the lucrative home market, are forcing New South Wales growers to sell a greater proportion of their crop on the lower-priced export markets.

Meantime, changes in export requirements (i.e. preference for long-grain, higher quality standards), shrinking markets due to changing nutritional standards, and over production, together with effects of the so-called "green revolution" in Asia, have all contributed to reduced prospects for rice on world markets.

Reaction to those effects in the Region have been: (a) the introduction, this year, of a Rice Appraisal Scheme, to pay the grower on the basis of quality (dockage for variation from set standards); and (b) a request to the Minister for Conservation to refrain from issuing additional rice licences this season, with the rice industry voluntarily agreeing to reduce acreage in the case of certain growers with higher allocations (while holding other allocations at the 1969 level).

In effect the rice industry is seeking to relate production to foreseeable market-requirements.

WESTERN REGION

Improved Staff Situation

The Region's services have been strengthened by appointment of 2 Economics Research Officers and an Extension Officer (Group Extension). Also, establishment of the Coonamble Agronomy District has provided more effective cover of the western portion whilst allowing re-organization of the Warren and Dubbo Agronomy Districts' boundaries to provide more workable units. *Inter alia* this has enabled attention to the irrigation developments in the Narromine, Trangie, Warren areas to be concentrated in 1 Agronomy District.

Improved Extension Service

Because of the improved staff situation, the Region's extension service is now more balanced.

Introduction of problem-solving meetings with groups in the eastern portion of the Region has proved successful. The meetings have provided for participating extension officers an effective means to assess the needs of producers.

Effective assessment of group extension outlets within the Region is indicating areas where further improvements can be made. It will increasingly enhance extension officers' effectiveness and assist the meeting of increased demand for their services.

This year Agricultural Bureau Branches were formed at Warren and Portland. Use of these and increased use of informal groups, as well as existing formal groups such as U.F.W.A. Branches, have improved the Region's extension service.

Agricultural Changes

Changes in many primary industries during the year have dictated regular re-assessment of the extension situation. Wheat acreage was reduced by 15 per cent in the eastern portion of the Region and 40 per cent in the western areas. There was an associated increase (10 per cent to 15 per cent) in acreage sown to oats, and 10 per cent in sown barley acreage.

A surge of interest in alternative crops with better market prospects has been evident. It resulted in spectacular increase of acreage sown to oilseed crops. Irrigation development (with establishment of the Buddah Lake Scheme and various on-river schemes) has led to increased acreages of summer grain crops, and expected further increases through current development of other off-river schemes.

A slight reduction in sheep numbers has been evident, though the improved season and some management changes resulted in increased wool production (by up to 20 per cent in some areas). Active interest in development of beef cattle enterprises has brought 82 per cent increase in beef cattle numbers over the last 2 years (25 per cent to 30 per cent increase during 1969–70).

The various changes in lines of production have been accompanied by increased demands for information, particularly of an economic nature and for enterprise selection.

Head Office Audio Visual Aids Sections

FILM AND PHOTOGRAPHIC SECTION

Field Officers' 35 mm Photography

Some 18,913 photographs by field officers (as against 14,970 in 1968–69) passed through the Photographic Aids Section for processing and return to the field as 35 mm slides for extension uses. The photographs provided 7,653 black and white and 11,260 colour diapositives, as against 6,670 black and white and 8,300 colour in 1968–69.

To help cope with the increased demand by field officers for photographic services, an additional Technical Assistant (Photographic Aids) was appointed.

Special Purpose Photography

The Photographic Aids Section made 2,452 prints and enlargements as against 2,162 in 1968–69. Most of the prints were to illustrate publications but some (20 in x 30 in enlargements) were for use in show displays.

Duplicate, colour slides prepared from extension officers' originals totalled 217; compared with 183 in 1968–69.

Some special assignments done by the Section included 34 macrophotographs of plant specimens from Russia and the Kew Gardens, London; photographs of the original Sir Joseph Banks Collection; a series of photographs of sheep country for mural size enlargements at the R.A.S. wool display; a 4 ft x 3 ft natural colour enlargement of a tropical legume prepared for the World Grasslands Congress; photography of the Royal Visit to Hawkesbury Agricultural College, the careers exhibition, the R.A.S. display and country shows.

Cine Film Production

Two clips were filmed for rural television programmes. These dealt with dairy hygiene and butter making. Two films were made for records purposes; the Royal visit to Hawkesbury Agricultural College, and "Symptoms of a Diseased Steer". For Regional production of television film clips 1,300 feet of raw film was issued to Regional Publicity Officers.

Cine Film Library

Programmes collated and forwarded to country officers for local screenings totalled 169, as against 220 in 1968–69 and 206 in 1967–68.

DISPLAY/DESIGNING SECTION

A modern Information Bureau was designed and erected for the R.A.S. Show display in 1970. Unfortunately this and some display materials were destroyed by fire when the Agricultural Hall burned in June of this year.

The Section prepared finished art work for show exhibits, field days, lecture aids and publications. These totalled 742 jobs. Special exhibits were prepared for displays at the opening of the new Government offices at Goulburn and Grafton.

RADIO SECTION

New Outlets

Two new and valuable channels for extension matter now operate, through a Sydney Radio Station with 20 co-operating country stations; a 4-minute rural news bulletin broadcast at 6·36 a.m. Monday to Friday, and a 15-minute rural session at 12.30 p.m. Monday to Friday. Tapes and news releases from Head Office and from the Regions' Headquarters feature prominently. The same station also broadcasts a 30-minute rural programme at 6.30 p.m., Mondays; to 15 co-operating stations. Again, Departmental material is well to the fore.

These programmes started after discussions between Station executives and the Department's Extension Officer (Radio).

Of additional interest: 14 Queensland radio stations also broadcast a daily 12.30 p.m. session specially prepared for them by the same network—including a significant amount of material from this Department's Northern, North Western, and North Coast Regions.

Head Office Specialists' Radio Interviews

The Extension Officer (Radio) recorded 136 interviews of Specialists from the Divisions of Plant Industry, Animal Industry, Horticulture, Extension Services, and the Biological and Chemical Research Institute. The tapes were for distribution to Regions. In some cases the tape was released to the A.B.C. and to commercial networks for inclusion in direct landline broadcasts.

Taxation Officers' Advisory Tour

Scripts were prepared and interviews recorded with 22 officers of the Taxation Department prior to their rural advisory tours. A special radio script was prepared also; for their use at country stations.

A lecture on 'public speaking', with special reference to radio and television, was given to the group in the week before their tour.

"Champion Wheat Farmer of the Year" Project

Nine country radio stations, covering 5 of the Agricultural Regions, are again presenting this Competition with Departmental co-operation.

The Extension Officer (Radio) is liaison officer between the network and the Department, and all tapes used in the 5-minute daily sessions are provided by the Department.

The Agricultural Bureau and Allied Group Activities

THE BUREAU BRANCHES

Branch Affiliations.—One hundred and eleven branches of the Agricultural Bureau of N.S.W. affiliated financially with their Advisory Council in 1969–70; 18 less than at 30th June, 1969. This lower total is to some extent due to amalgamation of some of the smaller branches into larger ones—representative of wider areas.

New Branches.—Six new branches were formed; Goodooga District, Macleay Valley, Milton and District, Portland District, Warialda, and Warren.

Defunct Branches.—The small branches at Bilpin, Halton, Lower Clarence, Merriwagga, Nashua, and Rocky Glen ceased to function. Bilpin Branch became a branch of the United Farmers' and Woolgrowers' Association (U.F.W.A.) as it wished to participate in important industry discussions of the type not within the Constitution of the Bureau.

Membership Total.—The total of branch members for whom an affiliation fee was paid to 30th June, 1970, was 6,976; a decrease of 117 in the 12 months. Eighty-eight per cent of members now use bank orders for the payment of fees.

Branch Activity Trends.—A feature this year was the large number of schools on the topics "Alternatives to Wheat" and "On Farm Storage of Wheat". They reflected the current situation in the wheat industry. No school on Wheat Production *per se* was asked for in 1969–70.

The number of schools on "Farm Economics", "Income Tax and Estate Planning" and "Investment" continued to increase. Educational group-activities concerning livestock enterprises remained at about last year's level.

Inverell Branch organized a tour of New Zealand for 35 members, in conjunction with the New Zealand Government Tourist Bureau.

Cootamundra Branch organized what was probably Australia's first "Lamb Tasting". Attendance exceeded 300 and further requests to attend had to be refused. Nine lamb dishes were presented, smorgasbord, at this promotional function. Widespread publicity was earned, and prompted many intra- and inter-State enquiries.

Many branches have requested speakers on "Drug Addiction", a subject of a session at the Annual State Conference.

THE STATE ADVISORY, REGIONAL AND DIVISIONAL COUNCILS OF THE BUREAU

State Advisory Council.—Each of the Agricultural Bureau Regions was represented in the State Advisory Council. Mid-Coast and Hunter, Northern, Southern, and South Western Regions were represented by 1 Councillor; the remainder by 2. Four Council meetings were held. The Council held a number of discussions on ways the Agricultural Bureau should be involved in helping to alleviate the economic problems of primary producers. Also, a sub-committee reviewed all sections of the Constitution and a new Constitution was approved by postal ballot.

The Council organized a reception for the World President for the Associated Country Women of the World, Mrs Aroti Dutt of India.

Forty-fifth State Conference.—This was held at the Hotel Florida, Terrigal, 8th–10th July, 1969, and officially opened by the Governor-General Sir Paul Hasluck, G.C.M.G. One hundred and twenty-three delegates attended. The address "The Challenge of Tomorrow" by Professor D. E. Tribe, Dean of the Faculty of Agriculture, University of Melbourne, promoted considerable discussion.

External Affiliations.—The Agricultural Bureau Advisory Council continued formal affiliation with the National Farmers Union (N.S.W. Chamber); Rural Youth Organization; Water Research Foundation; Australian Association of Adult Education; Post-Graduate Foundation in Veterinary Science; Bush Nursing Association of N.S.W.; and the Associated Country Women of the World.

Regional and Divisional Councils.—Currently, Regional and/or Divisional Councils are active in 7 Regions; 5 Regional Councils, and 3 Divisional Councils. Activities sponsored by them this year included: Central Coast/Cumberland's Annual Stone Fruits Field Day at Hawkesbury Agricultural College, and Dinner (175 attended); Mid-Western Regional Convention, at Young, on "The Future of the Farm Family Unit" (55 nominated delegates); Macquarie District Field Day, at the Soil Conservation Station, Wellington; South Coast and Monaro Division's Wool Symposium (80 attended); and Richmond Tweed Division's Aerial Agriculture Field Day (200 attended).

THE BEEF CATTLE BREEDERS' COMPETITION, 1969–70

The Rural Bank of New South Wales and the Department of Agriculture again co-operated with the Agricultural Bureau to conduct this Competition. There were 152 entries, as against 107 in 1968–69. The winner was N. D. Pinkerton of "Yarrawin", Scone; second place went to Mesdames M. J. and R. S. Harris, "Rivernook", Hillston; and third to Mr J. S. Chisholm, "Burmah", Graman.

Field Days in conjunction with the District and State judgings continued to attract beef cattle producers and thereby contribute to extension service.

AGRICULTURAL BUREAU SCHOOLS AND COURSES FOR FARMERS

Through its branches and Regional Councils, the Agricultural Bureau of N.S.W. conducted 109 schools and courses for farmers; compared with 93 in 1968–69, 95 in 1967–68, and 77 in 1966–67. Also, Agricultural Bureau branches sponsored 15 schools for homemakers, organized in association with the Women's Extension Service.

Department of Agriculture officers were still the more frequent lecturers at Bureau functions; but many speakers were drawn, as in the past, from other State and Commonwealth Government Departments, from Universities both intra- and inter-state, as well as from industry and commerce.

The range of Agricultural Bureau schools are shown as follows (attendance figures are in parenthesis):

Beef Enterprise Schools

Beef Cattle: 6—Baradine (55), Braidwood (70), Coffs Harbour (80), Cootamundra (150), Cowra (60), Young (45); *Beef Production:* 1—Narrabri (55); *Calves and Weaners:* 1—Arcadia (100).

Sheep Enterprise Schools

Ewe and Lamb Management: 3—Cooma (45), Cootamundra (180), Cowra (45); *Wool Marketing:* 4—Bathurst (55), Cooma (104), Goodooga (56), Merriwa (130); *Wool Production:* 2—Grenfell (65), Wallabadah (23); *Wool versus Synthetics:* 1—Goulburn (150); *Sheep and Wool:* 1—Condobolin (35).

Pig Enterprise Schools

Pig Raising: 5—Baradine (40), Bingara (42), Condobolin (28), Southern Cross (10), Inverell (20).

Pasture/Fodder Enterprises Schools

Pasture Establishment/Management: 4—Ariah Park (72), Forbes (15), Gilgandra (40), Portland (50); *Lucerne:* 2—Coonabarabran (72), Narrabri (30); *Subterranean Clover:* 1—Boorowa (22); *Fodder Conservation:* 2—Grenfell (50), Kempsey (55).

Cropping Enterprise Schools

Alternatives to Wheat: 5—Bingara (32), Dubbo (90), Inverell (100), Moree (200), Tamworth (35); *Irrigated Crops:* 3—Arcadia (47), Cowra (73), Nevertire (20); *Potatoes:* 1—Maitland (60); *Strawberries:* 1—Arcadia (65); *Viticulture:* 2—Coonabarabran (35), Mudgee (60); *Rice:* 1—Coleambally (45); *Wheat/Grain Marketing:* 2—Myamley (11), Parkes (85).

Agricultural Engineering Schools

On Farm Wheat/Grain Storage: 15—Ariah Park (45), Bathurst (4), Condobolin (80), Cootamundra (45), Cowra (100), Gilgandra (90), Merriwagga (48), Moree (52), Narrabri (25), Parkes (130), Wellington (45), West Wyalong (90), Inverell (not recorded), Dunedoo (not recorded), Carroll (not recorded); *Farm Machinery:* 3—Bingara (70), Coleambally (250), Walgett (52); *Welding;* 6—Ariah Park (18), Bellingen (25), Nimbin (20), Mallanganee (20), Macksville (10), Coffs Harbour (12).

Farm Finance/Management Schools

Farm Records: 2—West Wyalong (50), Warren (not recorded); *Income Tax and Estate Planning:* 8—Arcadia (16), Baradine (42), Boorowa (23), Coleambally (25), Dunedoo (6), Wyong (43), Narrabri (not recorded), Quirindi (not recorded); *Farm Finance:* 2—Queanbeyan (30), Raymond Terrace (30); *Farm Management:* 5—Cowra (70), Grenfell (60), Hexham (25), Tenterfield (30), West Wyalong (25), Woolomin (11): *Gross Margins Analysis:* 1—Blayney (22); *Stock Exchange Investment:* 4—Braidwood (27), Condobolin (40), Queanbeyan (25), Trangie (19).

Other Schools

Animal Health: 3—Queanbeyan (20), Boorowa (45), Milton (40); *Dairy Farm Management:* 1—Raymond Terrace (25); *Developing Light Soils:* 1—Dunedoo (17); *Fertilizers:* 2—Jingellic (8), Maitland (58); *Irrigation:* 2—Casino (35), Hastings Valley (not recorded); *Graziers:* 1—Tuena (30); *Public Speaking and Meeting Procedure:* 3—Boorowa (21), Coonabarabran (12), Walgett (20); *The Future for Primary Industries:* 2—Goulburn (95), Wauchope (60).

OTHER SCHOOLS/COURSES FOR FARMERS

Besides the group activities conducted by the Agricultural Bureau and the Women's Service (see later), the Department's Extension Services conducted 55 other schools for farmers; either at rural centres or at one or other of the Agricultural Colleges. The range of these schools was as follows (the figure in parenthesis indicating the attendance):

Livestock Management Schools

Beef Cattle: 4—Grafton (50), Mooball (108), Tambar Springs (75), Casino (120); *Beekeeping:* 1—Hawkesbury Agricultural College (20); *Pig Raising:* 4—Grafton (40), Yanco Agricultural College (80), Narrabri (70), Hawkesbury Agricultural College (27); *Poultry:* 1—Hawkesbury Agricultural College (120); *Dairying:* 1—Murwillumbah (47); *Sheep:* 2—Southern Region (not recorded); *Friesian Cattle Judging:* 1—Hawkesbury Agricultural College (not recorded).

Crops and Pasture Management Schools

Tropical Pastures: 1—Lennox Head (60); *Oilseed Crops:* 3—Gunnedah (70), Moree (125), Milguy (9); *Fertilizers:* 3—Taree (35), Ballina (30), Southern Region (not recorded); *Pastures:* 3—Tocal Agricultural College (15), 2 in Southern Region (not recorded); *Summer Grain Crops:* 2—Griffith (150), Hay (120); *Silage:* 1—Mittagong (100); *Alternatives to Wheat:* 1—Southern Region (not recorded); *Soil Fertility:* 1—Southern Region (not recorded); *Weeds:* 2—Barraba (26), Gravesend (27); *Rice:* 5—Leeton (20), Whitton (10), Finley (100), Deniliquin (80), Caldwell (70); *Graziers:* 1—Glen Innes (116).

Farm Economics Schools

Farm Management Economics: 2—Tocal Agricultural College (21), Wagga Agricultural College (43); *Dairy Farm Management:* 1—Grafton (50).

Agricultural Engineering Schools

Grain Storage and Handling: 5—Gunnedah (25), Balranald (30), Oaklands (42), Deniliquin (70), Southern Region (not recorded); *General Machinery:* 1—Grafton (40); *Rice Headers:* 3—Jerilderie (30), Deniliquin (35), Tullakool (45); *Welding:* 1—Southern Region (not recorded).

Other Schools

Property Development: 1—Walcha (30); *Rural Safety:* 1—Gunnedah (80).

Women's Extension Service

SCHOOLS FOR RURAL WOMEN

The Women's Extension Service organized 24 1-day schools, compared with 23 in 1968–69. Fourteen of the 24 were in association with branches of the Agricultural Bureau. The other 10 were with branches of the Country Women's Association. Distribution of the schools was as follows (the figure in parenthesis indicating the attendance): *Entertaining in the Home:* Tenterfield (68); *Food Presentation:* 3—Braidwood (43), Canberra (66), Trundle (28); *Home Freezing of Foods:* West Wyalong (61); *Planning Family Meals:* 4—Arcadia (34), Condobolin (32), Dunedoo (42), Maitland (20); *You and Your Silhouette:* Bowral (32); *Deportment:* Terrigal (36); *Expanding Your Horizons:* Wyong (36); *Good Grooming:* Orange (30); *Hair Care:* Condobolin (43); *Skin and Beauty Care:* 3—2 at Narrandera (124), Tottenham (36); *Wardrobe Planning:* 2—Bingara (12), Bowral (58); *Flower Arrangements:* Cobargo (75); *Gardening and Landscaping:* 3—Arcadia (50), West Trundle (30), Bedgerebong (44); *Home Furnishing and Decoration:* 2—Arcadia (23), West Wyalong (21).

The CSIRO, N.S.W. Department of Public Health, Australian Gaslight Company, Australian Dairy Board, Australian Fruit Board, Meat and Allied Trades Federation, Sydney Building Information Centre, Sydney County Council, Wool Board, Horticultural Society of N.S.W., and a wide range of authorities, associations, and trade organizations continued to assist the Division's promotion of extension services for rural women.

OTHER MEDIA OF WOMEN'S EXTENSION SERVICE

Individual Enquiries.—Requests for information by correspondence totalled 378 as against 390 in 1968–69. These were concerned with specialized recipes (148), food preserving (111), deep freezing of foods (31), home furnishing (9), home budgeting/management (4), ti-tree bark picturecraft (26), and miscellaneous (49).

By 'phone there were 690 enquiries and 37 in-person enquiries at Head Office.

Radio and Press.—Twenty three press statements were prepared; mainly concerned with the organization of schools, and 23 tapes were recorded for release to radio stations through regional channels. Three other tapes were prepared in conjunction with the A.B.C. and radio station 2GB. The Senior Extension Officer (Women's Service) appeared in two interview sessions on ATN Channel 7.

Commonwealth Extension Services Grant

The Chief of Division of Extension Services is responsible to the Director-General for administration of Commonwealth Extension Services Grant funds made available by the Commonwealth through the Department of Primary Industry to enhance extension services and applied research.

For 1969–70 the allocations for the various projects aggregated $1,078,011; as against $918,046 in 1968–69. The following tabulation, comparative for 1968–69 and 1969–70, lists the projects and allocations:

Project	*Title*	1968–69	1969–70
		$	$
501	Research Officers	65,075	88,300
502	Extension Officers	156,272	183,400
503	Field Assistants	109,153	120,300
504	Technical and Laboratory Assistants	46,742	47,800
505	Equipment for Officers	171,181	70,020
506	Motor Vehicles	52,600	23,700
507	Buildings	75,109	372,261
*508	Agricultural Trainees	..	28,000
†508	Materials for Demonstrations	26,641	..
509	Extension Aids	19,030	20,270
510	Library Services	34,104	15,000
511	Conferences and Study Tours Overseas	22,715	17,440
512	Grade Herd Recording	71,200	71,200
513	Conferences and Study Tours in Australia	68,225	10,100
514	In-Service Training	..	5,900
515	Post-Graduate Training	..	4,320
		$918,046	$1,078,011

* In the 1968/69 C.E.S.G. Programme included in Project 513.

† In the 1968/69 C.E.S.G. Programme included in Project 505.

The amount allocated in 1969–70 under Project 507 "Buildings" was largely used to provide a Regional Laboratory at Wollongbar. Other buildings for which funds are being provided from C.E.S.G. are the Agricultural Engineering Centre (approx. $66,000) and the Parasitology Laboratory (approx. $30,000); each of these buildings at Glenfield.

HAWKESBURY AGRICULTURAL COLLEGE

General

ROYAL VISIT

On 30th April, 1970, the College was honoured by the visit of Her Majesty Queen Elizabeth II and His Royal Highness the Duke of Edinburgh. After viewing a parade of stud stock on the College Oval they visited the Dairy Factory, the Beef Cattle Section, and the Library.

TRENDS

New Courses

The two year Poultry Technology Diploma Course started in April, 1970 with an intake of eight students.

The one year post-diploma/post-graduate Course in Rural Extension also started in April, 1970. The intake was twelve students.

Entry Standards for Diploma Courses

The Diploma of Agriculture, Diploma of Food Technology, Diploma of Dairy Technology and Diploma of Poultry Technology courses all require a pass in the Higher School Certificate; including English and Science compulsorily. The Diploma of Food Technology continues to require also a pass in Mathematics at the Higher School Certificate level.

It is foreshadowed that particular minimum levels of passes in English, Science, and possibly Mathematics will be specified in due course. Meantime, the Higher School Certificate curriculum (particularly in Science) seeming in a state of flux, it is difficult to be too exacting about minimum pass levels for entry to the College courses. Further, the new curriculum structure in the 1970 First Year Agriculture is compounding the difficulty of being precise about pass levels for entry. Future demand for entry may play some part in determining whether and by how much the standards be further raised. Meantime, entry of applicants will continue to remain competitive—with the rider that older applicants continue to be considered in accordance with merits of the particular case.

The Diploma in Rural Extension course has its own special entry requirements, including *inter alia* appropriate post-diploma/post-graduate experience.

Curricula

The Diploma of Agriculture curriculum has embarked on a unit system, with electives in the latter stages of the course. In 1970 and 1971 the College remains in transition; a bridging period wherein, as far as possible, the principles of the unit system are being applied to students proceeding through the "old" Diploma curriculum.

The Diploma of Food Technology and Diploma of Dairy Technology curricula are undergoing total revision. Subject to approval of the respective Committee of Advice, each of these Diploma courses may become three year courses as from 1971.

The Diploma of Poultry Technology course has had to be organized *de novo* and independently. It will be serviced with some of the common core of basic subjects in Science, Engineering, and Business and Social Studies. It may remain a two year course for some time, depending on demand for enrolment and on industry-reception of its graduates. A separate Board of Studies has been set up for this course.

The Diploma in Rural Extension course, being post-diplomate/post-graduate, is expected to remain more exclusively a separate entity.

Career Recognition of Diplomates from Upgraded Courses

The N.S.W. Public Service Board has recognized the Diploma of Agriculture from the upgraded course as equivalent to a three year University degree course. These diplomates, available after 1972, will receive corresponding salary recognition by the Board. Public Service Board recognition of the status of earlier diplomates and diplomates of other courses is under consideration.

Teaching Staff Structure and Salaries

With upgrading of the diploma courses, and emergence of clear plans for three year duration of the Dairy Technology and Food Technology Courses, further action has been taken to match the structure, numbers, and salaries of teaching staff with those of other Colleges of Advanced Education. Timing of an expected surge in staff recruitment to meet the needs for all courses depends on urgent resolution of these problems.

Meantime, some important new teaching positions have been filled: a Chief Lecturer and a Special Livestock Officer (Poultry) to support the Senior Lecturer in charge of the Poultry Technology course; a Food Technology Lecturer; and a third Chemistry Lecturer.

BUILDING PROGRAMME

The major projects completed this year were: a new 22-room residential block; five poultry buildings for the Poultry Technology Course; beef cattle shed and yards; a farm machinery and implement shed; A.C. roofs renewed on all dairy factory buildings; deep freeze unit and cold room installed at the kitchen; deep freeze unit, cold room and glycol tank installed at the Poultry Section; the old Stable Square converted, to house tractors; and the Old School of Engineering modified, to house mechanical and electrical tradesmen, before demolition of the old boiler house and workshop.

Considerable work has been done on the following: the Animal Husbandry Unit, Stage II; new School of Engineering and Physics Laboratory; the steamline from the Dairy Factory to the kitchen and accommodation blocks; a controlled environment building for the Poultry Technology course; and the Food Technology tutorial block, sited near the Dairy Factory (allowing integration of the Food Technology and the Dairy Technology Diploma Courses as a Food Science complex, as recommended by the Board of Studies).

The Five Diploma Courses

DIPLOMA OF AGRICULTURE

Student Numbers.—At present 174 students are in the Diploma of Agriculture course; 67 in Agriculture I, 52 in Agriculture II, and 55 in Agriculture III. Fifty-eight of the 174 are sons of farmers or graziers; 24 in Agriculture I, 17 in Agriculture II, and 17 in Agriculture III.

Of the 67 students admitted to Agriculture I in 1970, sixty-four have the Higher School Certificate and three the Leaving Certificate or equivalent.

Motivation of Students.—Thirty-three of the 67 in Agriculture I have expressed intention to seek career positions in Government service or private industry after graduation. Of the 19 students whose intentions are indefinite at this time, it is likely that most are considering career positions. Fifteen of the 67 have definite plans to go on back to the land.

Diploma Awards, 1969 *Class.*—The Hawkesbury Diploma in Agriculture was awarded to 60 students, one gained Honours Class I and five Honours Class II.

Employment of the Diplomates from 1969 *Class.*—The 60 Diplomates from the 1969 class obtained employment as follows:

On farming and grazing properties	13
Government Departments:	
(a) State Departments	21
(b) Other Government Agencies	3
Private Firms (agricultural supplies and services), as Technical representatives, etc.	4
Companies associated with Agricultural and Pastoral Industries	9
University studies	1
Teaching; Miscellaneous; or Unknown	9

DIPLOMA OF DAIRY TECHNOLOGY

The Changes.—The upgraded course in Agriculture was introduced in 1970 but the revised courses in Dairy Technology and Food Technology will start in 1971. The work put into the revision by members of all sections of the industry who serve on The Food Sciences Board of Studies, and various committees set up to advise on the courses, has been deeply appreciated. The envisaged main changes will be:

- Integration with the Food Technology course in areas common to both.
- Expansion of course to three years, necessitated by:
    - the present very heavy lecture load (8 hours/day for the three lecture days/week);
    - the amount of material to be covered, through ever increasing complexity of the dairy industry;
    - the time needed by students, through projects, to integrate the material taught as separate subjects.

Also, consideration is being given to allowing females to enrol for Dairy Technology.

Enrolments.—Thirty students are currently enrolled, sixteen in First Year and fourteen in Second Year. The admissions to First Year in 1970 comprised: two from Western Australia; three dairy factory apprentices; six sponsored by the N.S.W. Milk Board; two sponsored by Dairy Farmers Co-operative Ltd; one sponsored by United Dairies Pty Ltd; one from Zambia, supported by the Zambian Dairy Produce Board; and one (from New South Wales) without financial apport.

Diploma Awards, 1969 *Class.*—Fifteen students were awarded Diplomas in Dairy Technology. One gained Honours Class I, one Honours Class II, and one failed.

Employment of the Diplomates from the 1969 *Class.*—One of the fifteen Diplomates is currently employed in Tasmania, three in South Australia, one in A.C.T., and ten in New South Wales.

DIPLOMA OF FOOD TECHNOLOGY

The Changes.—In keeping with the acceptance of this as a Course of Advanced Education, the curriculum changes being made will increase the scope and depth of vocational training. The Food Science Board of Studies has been working to review and upgrade the course to the applied tertiary level. The Board of Studies recommended that from 1971 this shall be a three-year course.

Facilities.—Construction of a well-equipped tutorial block (comprising lecture theatre, a reading and audio-visual aids room, laboratories, preparation and storage area, offices and ancillary service units) has started. Money has been allocated to provide a new processing area, to be completed during the current triennium. Planning of the processing area is at an advanced stage.

Appointment of a third Lecturer in Food Technology has brought the professional staff up to its full quota for the first time.

Student Numbers.—All students admitted to the Food Technology Course in 1970 have the Higher School Certificate or equivalent qualifications. Four of the 30 students are females. The thirteen students in Food Technology II include two females.

Nineteen of the Food Technology students have financial assistance by way of Company sponsorship or scholarships. The Food Technology Association of N.S.W. provided one scholarship.

Diplomas Awarded, 1969 *Class.*—Nine students were awarded Diplomas in Food Technology. One gained Honours Class II.

Employment.—All Diplomates from the 1969 Class are employed by private industry. Eight are in New South Wales and one in South Australia.

DIPLOMA OF POULTRY TECHNOLOGY

The First Intake.—The seven students for this course arrived on 13th April, 1970. Six of them have the entry requirement, the Higher School Certificate in English and Science. Maturity was an admission factor in the other case. One more student may be added to the class, through allocation of a Departmental Traineeship.

Staff.—Two of the three academic staff positions have been filled: the Senior Lectureship and a Special Livestock Officer position. Involvement of a part-time lecturer in the early stages of the course has also been approved.

Facilities.—Five poultry buildings have been completed. A sixth, a fully-insulated controlled-environment broiler shed, is near completion. An office/laboratory has been planned. Improvements to existing feed-mixing, broiler-processing, and product-storage facilities have been made with College funds.

DIPLOMA IN RURAL EXTENSION

An Historical Development

Availability of this course is a significant, historical development in Agricultural Extension in Australia. For the first time, agricultural college diplomates not possessing a university degree are offered specialized tertiary training in the educational, behavioural science and farm management economic aspects of their work. At the same time the course is available to university graduates. Previously in Australia there were only the post-graduate Diploma courses at University of Queensland, Brisbane, and the University of Melbourne.

The N.S.W. Department of Agriculture is sponsoring the course. Financial assistance from the Commonwealth Extension Services Grant has been a major aid to its establishment.

The Course.—The course draws on the social science disciplines—educational psychology, social psychology, sociology, and economics, and the sub-disciplines of farm management, decision theory, group dynamics, etc. Among the activities are: a field project involving conduct and study of an on-going extension programme; intensive training in farm economics and management; a behavioural sciences programme combining lectures, films, reading, and discussion; and a similarly activated programme on the process and techniques of rural adult education. The course is so designed that an individual programme may be developed for a course member with special needs.

Entry Standards.—Applicants, graduate or diplomate, must have had a minimum of three years' active participation in extension work.

Sources of Participants.—Extension officers employed by the N.S.W. Public Service Board will comprise the majority of the student intake but applications have been and will continue to be invited from interstate and non-government agencies. One of the students in the Foundation Class, 1970, is from South Australia; the eleven others from New South Wales.

The First Intake.—The twelve students for this post-diplomate/post-graduate one-year course arrived on 13th April, 1970.

ASSISTED STUDENTS—ALL COURSES

Of the student total in 1970 (252, in residence), 147 (54%) have bursaries, scholarships, traineeships or other forms of sponsorship. It is encouraging that so many opportunities are being offered to students. Many of them might not have been able to receive a college education without sponsorship. Twenty of the 252 are N.S.W. Public Service Board trainees (Department of Agriculture or Department of Conservation).

PRACTICAL TRAINING

Emphasis continued on provision of practical training for all students.

Some Changes

A Supervisor of Practical Training was appointed at the start of 1970, to concentrate wholly on student practical-training in the Agriculture course. Previously the Lecturer on Beef Cattle supervised (part-time) the student practical-training as well as the Beef Cattle Section.

With upgrading of the Agriculture course from 1970 there have been major changes in the organized practical training. All students from a complete Course Year now engage in practical work for an entire term. Practical work includes being rostered around all sections of the College; organized tuition in selected skills; many more field demonstrations and activities than hitherto; and short educational-tours as well as seasonal tours.

Extra-mural training on private farms is still an important aspect of the practical training.

Tours and Visits

Students had opportunity to participate in a number of single-day tours to reinforce and supplement the study programme. Also, Final Year students proceeded on major tours: for Agriculture students the northern, western, or southern district tours; for Food Technology students the visiting of processing plants in the Goulburn Valley and Melbourne; for Dairy Technology students the visiting of the Hunter Valley districts.

Dairy Technology students, First Year and Second Year, attended two meetings of Nepean/Hawkesbury section of the Australian Society of Dairy Technology.

Extra-Curricular Activities

Extra-curricular activities continued to be an important feature of student life.

The various sporting teams maintained the high tradition of College sport. Positive contributions were made to the social life and welfare of the College by the Students' Representative Council, the Sports Club, the Debating Society, the Camera Club, the Students' Christian Movement, the Fratres Colendi, the College Branch of the Agricultural Bureau, and the Hawkesbury Collegians Service Club.

Public Relations

The College, proud of its widespread fine reputation, continued to enhance its relations with people and organizations.

The traditional *Visitors' Day* (Thursday, weekly) is still heavily used. But by special arrangement on other days, including weekends, individuals and groups have been allowed to inspect the College. Whilst some obviously visit the College as a tourist attraction, most have a real interest (general or specific) in its activities. The visits, however informal, are regarded by the College as effective forms of extension as well as means of good public relations. Amongst the visitors have been many agriculturalists from other States and from overseas; including many from Asian countries.

College Liaison with Other Organizations

The College continued two-way co-operation with many appropriate government, semi-government, and private organizations. Among these: other State Government Departments, the Commonwealth Department of External Affairs, the CSIRO (several Divisions); the Atomic Energy Commission, the ABC, Universities, Banks, Local Government bodies, growers' organizations, various technical societies, the Agricultural Bureau and the Rural Youth Movement, and many companies associated with agriculture.

Short-term Schools and Conferences at the College

The short-course schools and conferences held at the College this year included (attendances in parenthesis): A Rural Youth School (Farm Management) (40), a Herd Recorders School (45), two Extension Methods Schools (38 and 46), a School for Foremen on Food Technology (50), a Poultry Servicemens School (40), a Pig Raisers School (24), the Rabbit Inspectors Refresher Course (30), a School on Microbiology of Meat Products (20), a Small Goods School (20), and a Summer School in Agriculture.

New Staff Positions

The new positions and the appointees (in alphabetical order) were: Executive Officer, Mr D. K. Bartels, B.A., B.Ed, ASTC; Liaison Officer, Mr P. Rukin; Chief Lecturer, Rural Extension, Mr J. G. Bird, B.Ag.Sc., M.Ag.Ec.; Senior Lecturer, Rural Extension, Mr R. D. Macadam, B.Sc.Agr., Dip.Ag.Ext.; Senior Lecturer, Poultry Technology, Mr R. Sledge, M.Sc., Dip.Ed.; Special Livestock Officer, Poultry Technology, Mr J. W. Twyford, B.Sc.Agr.; Lecturer in Chemistry, Mr J. A. Hourigan, B.Sc.; Lecturer in Food Technology, Mr P. A. Hicks, B.Sc.; Lecturer in Economics, Mr D. Gamble, B.Ag.Ec.; Supervisor of Practical Training, Mr G. Bennett, H.D.A., H.D.D.; Livestock Officer (Apiculture), Mr C. S. Wilson, H.D.A.; Livestock Officer (Sheep and Wool), Mr B. C. Baillie, H.D.A.; Dairy Research Officer, Mr L. M. Browning, H.D.D.T.; Storeman, Dairy Products Factory, Mr A. Zemarz; Technical Officer (Scientific), Mr S. B. Peterson; Laboratory Assistant in Training, Miss A. Baker.

Besides the new positions, some twenty-one other changes in personnel occurred; occasioned by transfers, retirements, resignations.

Some College Sectional Operations

FARM; AGRONOMY RESEARCH; ORCHARD; SHEEP; BEEF CATTLE; DAIRY CATTLE; PIGGERY; POULTRY; APIARY; DAIRY TECHNOLOGY; FOOD TECHNOLOGY

Farm Section

Crops and Pastures.—The 1969 grazing crops provided a heavy bulk but those sown in autumn 1970 failed other than where irrigated. Even the latter have disappointed. The non-irrigated areas of oats and barley have provided no grazing.

After an excellent 1969 spring and ample pasture grazing to the end of that year, all improved-pasture paddocks have become severely drought-affected. These paddocks have provided no grazing in 1970. More than 300 acres was sown to improved pasture in autumn 1970, but on present indications will fail because of lack of rain and will need to be resown in autumn 1971. Ten acres of lucerne sown at the River Farm in 1969 is under irrigation, and showing good promise.

Twenty-three acres of maize, sown late in the 1969 spring, yielded up to 18 ton of haylage/acre, and 60 bushels of grain/acre came from a further eight acres.

Conserved Fodder.—Through lack of pasture, demand on conserved fodder has been heavy in recent months. By spring 1970 the hay supplies will be very low but there is still at least 1,000 ton of pit silage. This should meet large-stock needs for a considerable time. Grain supplies have been depleted and, with none available on Departmental transfer to the College, is now being bought on the open market.

Water Supplies.—Irrigation has made heavy demand on the "Turkey Nest" and the "Hillside" dams. About 20,000,000 gallons remain in storage but without good rain or storms to cause run-off the end of irrigation supplies is threatened.

Horse Auction.—The first auction sale of the Deparment's Arabs took place on 23rd April, 1970. Sixteen mares, a colt and a foal were offered. Half the offering came from Wagga Agricultural College. The sale was highly successful. Price average for mares was $2,050. The colt and the foal each realized $1,100.

Agronomy Research

Detail of the work and results of this section of activities at the College has been reported to and incorporated in the report of the Division of Plant Industry. An outline of the areas of work is as follows:

Two new tomato varieties bred here ("YTMF2" and "YTMF3") were released for the canning industry. These are a new type of canning tomato. The bushes are very small and fruit maturity is highly concentrated—enabling the entire crop to be harvested at once, either by hand or by machinery. The varieties are resistant to *Fusarium*-wilt.

Use of various combinations of clear and black plastics over trellised tomatoes doubled the early spring yield of smooth skinned varieties.

Testing of over 200 stringless dwarf bean varieties has led to the release of "Apollo", a new introduction, to the canning bean industry. Apollo is resistant to summer-death disease, and superior in quality and yield to Gallatin 50—the leading commercial variety used by the canners.

A maize trial established this year, in factorial design, is concerned with: various hybrids, populations, rate of nitrogen, row spacings, tractor planting, tilling, and cultivation.

Two weed control trials are in progress: one in onions and the other in beetroot. In the beetroot trial, TCA + pyramin, dalapon + pyramin, and betanal are most promising. In the onion trial, vegedex was most promising.

The College research agronomists were concerned also with some projects away from the College. They laid down "time of sowing" and variety trials with stringless beans at Tweed Heads and in Gosford. The variety Leeton showed promise at Tweed Heads. Also in the Tweed Heads and Gosford districts: yield trials of market-tomato hybrids, and trials of plastic covers for trellised tomatoes. At Bankstown airfield: a trial for total vegetation control.

Crops were grown for the CSIRO Division of Food Preservation, the University of Sydney Wheat Research Unit, and the University of New South Wales for quality and storage studies.

Co-operative research was done with the University of Sydney, University of New South Wales, the CSIRO, various Divisions of this Department, seed firms, and chemical firms.

Extension Activities.—The Agronomy Research section was represented at Field Days at Gosford, Leppington, Mangrove Mountain, and Terrigal for tomato growers, at Kingscliff and at Gosford for market-bean growers, at Camden on soybeans, and at Narromine on galvanized burr. Also, talks and demonstrations arising from the research programme were given at the College, the University of Sydney and to high school students.

Orchard Section

Crops and Developments.—The year generally was satisfactory for orchard operations. Growth progress for all trees was outstanding. New plantings and nursery trees established very well. Green manure crops provided a large bulk for turning in, with noticeable improvement in soil condition. Peach, pear, and citrus crops were heavy and high quality. Supplies were adequate for College needs. Some 1,200 bushels were supplied.

Educational.—The Orchard provided good facilities for demonstrations and the general practical training of students. All demonstration plantings were well maintained.

Further demonstration projects were established. These include soil management plots using herbicides to maintain a bare surface, new irrigation systems including "Trickle", or "Drip", and "Drag Hose" (moisture testing equipment has been procured and is used for instruction), and an area of aged citrus trees being renovated by skeleton-pruning and making excellent progress.

Educational activities centred around the Orcharding course for Agriculture and Food Technology students; lectures, demonstrations, practical work on the section, and visits to district properties. However there were also extension activities for the fruit industries, including: a field day, advice through personal contact with visitors and by telephone and correspondence, and visitors observations in the demonstration areas. A Stone Fruit Field Day in January was well-supported.

A highlight is the progress of new peach and nectarine varieties; a demonstration area comprising sixty peach trees of nineteen varieties planted in 1967, and forty eight nectarine trees of eight varieties planted in 1968–69. Also, in the selected strawberry seedlings from the Narara breeding programme, grown for observations on suitability for this district, several seedlings have shown promise.

Sheep Section

Lambing, 1969.—Results overall were again very poor. Ram infertility in the prevailing conditions was implicated. Growmark ewes failed to lamb. Stud Merinos lambed 6·0 per cent only. Crossbred and Merino-cull flocks lambed 150 per cent and 110 per cent respectively.

Matings, 1970.—Mating was done under very dry conditions, but ewe bodyweights were satisfactory. Mating groups were as follows: *Sire Comparison Trial*—150 first cross ewes mated to Dorset, Southdown, Growmark, Suffolk, and Corriedale sires; *Pre-Mating Shearing*—thirty-one first cross ewes to Dorset sire; *seven months of age mating*—thirty-one first cross ewes to Dorset sire; *Growmarks*—forty-nine ewes to Growmark sire; *Cull Merinos*—90 ewes to Border Leicester and Romney Marsh sires; *Stud Merinos*—190 ewes to four Merino rams.

A Spring Mating.—Sixty-four first cross ewes were mated in spring 1969, to lamb in autumn 1970; to give students (under the new "practical-work term" system) better experience, and to test spring mating at the College. A Corriedale sire was used. Some 78 per cent of lambs were born, A similar group will be mated in the 1970 spring.

Research and Student Projects.—1. Prime-lamb sire comparison—using Dorset Horn, Southdown, Suffolk, Growmark, and Corriedale sires on Border x Merino ewes. 2. Pre-mating versus pre-lambing shearing. 3. Feasibility of mating first cross ewe lambs at 6–7 months of age. 4. Drought feeding project—to evaluate biuret as a supplement to low quality feed. 5. Sire comparison—Border Leicester and Romney Marsh rams as sires of first cross ewes. 6. Weaning of autumn drop lambs—comparison of groups weaned at twelve weeks and non-weaned. 7. Merino stud ram demonstration—comparing housed and paddock rams (similar genotype). 8. Growmark breed evaluation. 9. Stud Merino breeding—the selection methods.

Flock Statistics.—At 30th June, 1970 the 1,199 head comprised 342 Commercial Flock ewes, 186 Merino Flock ewes, twenty-one Merino hoggets (ewes and rams), seventy-nine Rams (assorted), 522 ration sheep, and forty-nine Growmarks.

At shearing, 32 bales weighing a gross 9,872 lb was the result—netting $2,613.

Beef Cattle Section

Beef Cattle Total.—Cattle total of all herds (Stud, Commercial, Demonstration, and Ration) reached 410 head during the year.

Stud Herd.—After heavy culling and re-organization of this herd last year, the present policy is to consolidate breeding material and cull entirely on performance-record of females.

The sires used were "Kildrummie Toledo", "Kildrummie Youth", and the College-bred performance-selected bulls "Hawkesbury Freebooter" and "Wirrina Dalkeith". In the ensuing year the breeding programmes will feature even greater use of College-bred bulls selected from the Sire Selection Demonstration. Breeding-herd organization on sire lines is now completely in operation.

The Stud herd now comprises sixty-one females, of all ages, and twenty males—including four sires. Three bulls, including two that were top performance-tested animals, are on loan to the Graham Park Artificial Insemination Centre, Berry. The remaining thirteen yearling bulls are currently being evaluated in the Sire Selection Demonstration. Five yearling bulls were either transferred or sold.

Commercial Herd.—The herd size remains at about eighty breeders plus replacement heifers. Cull animals and steer progeny are used for rations after completion of demonstration work. Expansion of the herd is not envisaged. It is big enough for a wide range of management and husbandry demonstrations.

The herd continues to show improvement through use of Stud sires; measured through performance-recording programmes and performance comparisons with Stud females.

Steers produced in the "Steer Production Demonstration" were again exhibited at the R.A.S. Steer and Carcass Show. The College won two classes, for "pens of three carcasses", and also a Fourth prize in one of these classes. One pen of carcasses gained the Championship.

Demonstration Herd.—Emphasis on diversity of breed material continued. This has proved invaluable for student instruction.

Charolais x Friesian crossbred calves were added this year, through the co-operation of the College Dairy Section—where the initial inseminations were done. Charolais crossbreds are currently being compared with a wide range of Brahman crossbreds.

The Criss Cross and Rotational Crossbreeding Demonstrations now well established are providing interest to students and producers. Emphasis is also put on Dairy/Beef production techniques, including multiple suckling.

The Brahman bull "Laws Scimitar" continued to be an invaluable acquisition in the student-instruction programme.

Co-operation and interest in the results from this herd continues from outside sources, including that of Professor Butterfield, School of Veterinary Science, Sydney University; and the assistance of the Director, Graham Park, A.I. Centre and his staff is gratefully acknowledged.

Some fifty females have now been organized into the herd.

Ration Herd.—Eighty head, nominal value $10,000, were slaughtered for rations. The majority were produced on the College, but some were received by transfer from other Research Stations.

Instructional Demonstrations and Trials.—These continued as a feature of the Beef Cattle Section's activities. A wide range of husbandry methods was organized with student participation.

Long-term demonstration and trial projects for student instruction comprise: 1. *Breeding herd management*—concerned in particular with management of breeding, calving, nutrition, herd improvement, and marketing. 2. *Steer production demonstration*—including economic evaluation of steers produced under a pasture management regime compared to feed-lot finishing. 3. *Castration*—comparison of hemi-castrate animals with fully castrate animals, for production efficiency and carcass merit. 4. *Performance recording*—for culling and selection of replacement heifers, both stud and commercial. 5. *Performance recording*—for culling and selection of beef sires. 6. *Supplementation trial* (in co-operation with Dow Chemicals)—comparing biuret and urea as protein-replacement supplement whilst fed with low-protein roughage. 7. *Breed influence*—on crossbreeding practices and controlled cross-breeding systems. 8. *Synchronized oestrus and artificial insemination*—involving breeding of the entire Demonstration Herd by this means (with gratefully acknowledged co-operation from the Director of Graham Park A.I. Centre).

Dairy Cattle Section

Breeding Programme.—Again extensive use was made of semen from Canadian-bred bulls and their progeny. A recently imported New Zealand bull "Deloraine B.A. Endeavour" has been used to some extent on the younger cattle. He carries the breeding of Canadian bulls related to those imported to Australia in 1956.

A number of cows that calved to imported Charolais semen, and their calves, have been transferred to the Beef Cattle Section.

Twenty ampoules have been bought, from the semen recently imported from U.K. from the Canadian-bred bull 'Suttonhoo Edema Dividend". This bull has a double cross of "A.B.C. Reflection Sovereign"— a son of "Spring Farm Fond Hope", the great grand sire of most of the College Friesian herd.

Friesian Stud Statistics.—At 30th June, 1970 the 161 head comprised eight adult bulls, nine loan bulls, forty-five cows in milk, sixteen cows dry, twenty-five heifers, and sixty-two calves under twelve months.

Stud Sales.—The College Freisans are in very high demand, with a 3 to 3½ years waiting list in respect of young bulls. Twenty-five Friesians were sold, for $5,580—an average of $227.

There was greatly increased demand by other Departmental institutions on stock for research projects. Also twenty-seven females and a male were transferred to the Department's newly acquired C. B. Alexander Agricultural College, Tocal, as nucleus of a Friesian stud to be established there.

Bulls were loaned to the N.S.W. Milk Board, for artificial-breeding centres.

Herd Production Averages.—The latest released herd-recording figures are for the twelve months ended June, 1969:

Age	No. Cows	Total Milk	Total Fat	Average Test (%)
		lb	lb	
2 years old	7	11649	428	3·7
3 years old	8	13001	486	3·6
4–9 years old	29	15097	551	3·6
Over 9 years	11	14155	500	3·5
Herd average	55	14165	513	3·6

The College was second in the State for butterfat and third in the State for milk production; for all breeds, herds of over 40 cows. The 513 lb of butterfat was the highest average ever for a Department herd, of any breed.

Exhibition of Cattle at Shows.—A team of seventeen College Friesians was exhibited at the 1970 Sydney Royal Show. The results included a Reserve Junior Champion, five Firsts, four Seconds, six Thirds, one Fourth, and three Fifths. The Firsts comprised two in "Sires Progeny" groups and three in "Type and Production" classes. The College was "Most Successful Exhibitor" for the 10th consecutive year, and again won the "Most Successful Breeder" award in the Friesian section. The College has won the latter in each of the four years it has been presented.

Twelve head were exhibited at the 1970 Hawkesbury District Show—this year's Friesian Cattle Club feature show. The College was "Most Successful Exhibitor" in the Friesian section. It gained nine Firsts, five Seconds, three Thirds, Champion Cow, Reserve Junior Champion Heifer, and Reserve Champion Bull.

Two of the College cows and one bull have recently been rated "Excellent", under classification for type, and general herd rating is "Good Plus".

Trials and Experiments.—The continuing Solids-Not-Fat (S.N.F.) testing programme has been extended by the regular monthly tests, for milk protein, of the College herd and of the A.I.S. and Jersey herds located at Grafton. The milk samples of the Grafton stock are received by post each month in special containers.

Growth and development studies of Friesian calves under different rearing conditions have been started as a student project and relative to the various research activities proceeding at other institutions. A mastitis trial is also continuing.

Judging School.—A successful Friesian Cattle Club "Judges School" was held at the College in May, 1970.

Piggery Section

The Stock.—Seventy-four litters were farrowed. The Large White, Landrace, and Berkshire herds were extensively culled and now comprise young gilt replacements in the main. The Tamworths have been reduced to a token, three sows.

Large White, Landrace, and Berkshire boars were introduced from private studs, and good influence on herd quality is already apparent. Large White and Berkshire sows were received from Grafton Agricultural Research Station.

The total of stock on hand at 30th June, 1970 was 238. The breeding stock comprised a Tamworth boar and two sows, two Berkshire boars and eight sows, three Large White boars and nineteen sows, and two Landrace boars and seventeen sows.

Stud and Market Sales.—Early in the year the market price was very depressed. This in turn reduced the demand for stud stock. Thirty-four stud animals were sold, realising some $1,733, and 129 head were marketed, realising some $2,603.

Supplies to Institutions and Research Centres.—Fourteen stud pigs were supplied free to other Government Departments. Eighty-four pigs were supplied free to research institutions (the James Fairfax Surgical Research Unit, Childrens Medical Research Foundation, Royal Alexandria Hospital for Children, University of Sydney, and Glenfield Veterinary Research Station) and 212 to the College as rations.

Demonstrations.—Demonstrations done during the year or currently in hand comprised:

1. *Protein Feeding*—
    - (a) effect of varying levels of protein supplementation on growth rate, efficiency of feed utilization and carcass quality;
    - (b) effect of various protein supplements on performance and economy of gain;
    - (c) effect of supplementation with lysine and methionine at varying protein levels.
2. *Vitamin and Mineral Additives.*—Effect of various vitamin and mineral additives on performance.
3. *Fibre Tolerance.*—Effect of varying percentages of fibre (using oats) on economy, performance, and carcass quality.
4. *Breeding.*—
    - (a) multiple matings and subsequent litter mates with different sires;
    - (b) litter testing;
5. *Environment*—
    - (a) effect of temperature and humidity on growth rate and economy of gain;
    - (b) effectiveness of insulation.
6. *Management.*—Early-weaning demonstrations.

The Poultry Section and the School of Poultry Technology

At this early stage of development of the *Poultry Technology School*, for the new Diploma in Poultry Technology, continuing identity of the *Poultry Section* of the College is apparent.

The *Poultry Section* centres around the Layer Random Sample Test, and instruction to Diploma of Agricultural students. Staff-wise, this subdivision has remained relatively unchanged. Facility-wise, a glycol cooling tank and deep freeze units have been important additions to the small processing plant. If proposed legislation is enacted this plant will probably have to be rehoused. The egg room has been modernized and fitted with air conditioning and a new metal egg grader. Development of the feed mill has been completed to allow bulk handling of the ration constituents.

The 17th *Random Sample Layer Test* was concluded and results published.

The annual *Poultry Farmers field day* was one of the most ambitious yet staged, and very successful as judged by the attendance and the standard of commercial displays.

The *Poultry Technology School* is at a crucial development-stage as regards staff, facilities, curriculum, and attracting appropriate students. A Senior Lecturer has been appointed (Mr R. Sledge; previously on secondment from Seven Hills Poultry Research Station), also a Special Livestock Officer (Mr J. W. Twyford), and a field assistant and a stock attendant. The still vacant, second Senior Lecturer position has been re-advertised in Australia and also in the U.K. Another field assistant position will be filled shortly.

A broiler shed, pullet cage-rearing shed, deep-litter laying shed, two cage-laying sheds and a controlled-environment broiler shed have been completed.

Temporary facilities have been used to conduct student lectures and seminars. For staff accommodation—the limit of subdivision within the old Poultry Section Office has been reached in attempting to provide space for staff already on the job and those expected shortly.

A course has been provisionally devised with four "themes": basic science subjects, farm management subjects, poultry technology subjects, and industrial experience. In this initial period the emphasis naturally has so far been on basic science and the lectures in seven subjects given to First Year Diploma of Agriculture students have been utilized. A start has been made on farm management, and on technology—wherein poultry nutrition and avian physiology have been covered in some depth. Further development of the curriculum awaits the work of Subject Advisory Subcommittees and the formation of a Board of Studies.

Practical work has been at the Poultry Section and has involved two projects for the students: 1. Maintenance of birds, and collection of data from pullets kept in cages of various dimensions; 2. A study of chick growth on variously concentrated diets. Weekly, commercial farms, and other places of interest in the Sydney area have been visited, e.g., egg-producing and broiler farms; the N.S.W. Egg Board floor, Lidcombe; a processing plant; and a feed mill.

An inaugural meeting of key personnel in the poultry industry was held in May, 1970; to inform them on developments, aims and objectives, and general form of the course, and to initiate moves to form Subject Advisory Subcommittees.

Apiary Section

Production.—At 30th June, 1970 there were ninety productive hives and thirty nucleus colonies, compared with ninety-six and forty respectively at 30th June, 1969.

Cool wet conditions in the 1969 spring made it difficult to maintain the queen-rearing nuclei, and colony strength in the productive hives. Supplementary feeding was continuous. At the end of October and early in November all productive hives were migrated to Bathurst where there was an excellent flowering of Paterson's Curse. Colony strength built up. Surplus honey was stored, and combs of honey were transferred back to the queen-rearing nuclei. In summer an additional supply of honey was had from Yellow Box and Red Gum.

A total of 4,400 lb was extracted from the bees at Bathurst, and 2,700 lb from the Departmental Apiary at Tamworth—now given periodic attention from the College.

In February most of the bees that were migrated earlier to Bathurst were brought back to local sites for autumn-flowering Bloodwood trees. These yielded enough nectar for winter stores but no surplus for extract.

Winter flowering Swamp Mahogany and Mugga Ironbark in the vicinity of the College apiary have caused some adult bee mortality, but out-apiaries are expected to winter in good condition.

Queen Bee Supplies.—Local conditions improved during the summer, and production of queen bees was able to be increased to meet the unprecedented demand. For the past ten years the demand for College-bred queen bees has increased each year. A record total of 950 were supplied this season.

Summer School and Field Day.—The annual Summer School in Agriculture was held from 4th to 8th January, 1970. Demonstrations were given at the Amateur Beekeepers Association Field Day at the College on 28th February, 1970.

School of Dairy Technology

General.—The previously reported problem of inadequate supplies of milk for manufacturing purposes, from the commercial and the student instruction viewpoints, was overcome by purchasing a smaller quantity of milk on a regular weekly basis. Skim milk was also available in regular quantities and part of this was manufactured into skim cheese. Cream for buttermaking also improved in quality, and market milk supplies were satisfactory.

Needed major renovations to the dairy factory have started. Also, new plant included a new roller drier, a constant-hold device for skim-milk processing, a deep-freeze unit for ice cream sales, and an extraction pump for evaporators.

Butter Section.—Butter production increased by some 25 per cent due to better seasonal conditions. Student instruction thus improved. Smaller boxes for print butter were introduced, consistent with modern-packaging trends.

Ice Cream Section.—Ice cream sales increased. A new pack is about to be introduced, the supply of former packages having been exhausted. Purchase of a new ice cream churn has been budgeted. The new one would permit production of more sophisticated varieties.

Market Milk Section.—Sales of market milk increased slightly, due to increased population. Flavoured milk sales have declined by nearly 50 per cent, mainly due to other beverages becoming more popular in the distribution area. An effort will be made to increase sales in the coming year. Market-milk supplies will be on quotas in the new year.

By-Products Section.—Pasteurized-skim supplies continued at regular bi-weekly intervals throughout the year, and increased by some 5 per cent. The new gouda roller drier was received in April, 1970; 3 months behind schedule because of world-shortage of stainless steel. Installation has also been delayed, partly due to industrial troubles. The drying section has been out of action since April pending major renovations to floors.

Spray-drying of skim milk was confined to dried skim for recombined milk and for ice cream manufacture. A defect in the "Niro" spray drier has not been rectified, and may not be unless the air-flow is changed. Reduced output of dried milk was primarily due to the plant being out of action during renovations to the building. A constant-hold device was installed in October, 1969, to hold skim milk during the manufacture of specialized skim-powders for recombined milk.

Cheese Section.—Cheddar cheese production increased by 130 per cent compared to the previous year and was more consistent with production over the past five years. The increase was mainly because of regular weekly purchase of milk from a nearby factory. Regular sales to Government Stores Department recommenced in March, 1970; at a price lower than previously but slightly higher than ruling rates on the Sydney wholesale market.

Sales of 2½ lb cheeses ex the College store increased, compared with the previous year. Skim-cheese production increased by 100 per cent, partly because of need to absorb all of the skim into cheese so long as the by-products section is out of production.

Fancy cheese activities for student demonstrations improved slightly. Rindless Swiss, Edam, Roman, Blue Vein, Cottage Cheese, plain and fruit flavoured Yoghurts, and Processed Cheese were made.

Dairy Industry Act Certificates of Competency.—Theory examinations in Milk Grading, Milk and Cream Testing, and Cream Grading, for Certificates of Competency issued under the Dairy Industry Act, were conducted in the final examination of First Year students. Practical examinations are made by specialists from the Division of Dairying, when the students are in their Second Year.

Dairy Factory Processing and Production Statistics (*with the previous year's in parenthesis*).—One hundred and nine thousand three hundred and fifty-five lb butter (87,000); 166,114 lb cheese (72,400); 1,026,016 lb milk from Nepean Milk Co. surplus (300,000); 3,597,245 lb pasteurized milk for the Board (3,361,000); 281,208 lb milk from the College (293,000); 283,202 lb milk from dairymen's surplus (nil) and 58,736 lb milk from dairymen's rejections (nil); 2,606 gal ice cream processed (2,369); 66,083 lb dried milk (85,000); 5,746 lb condensed milk (6,000); 2,252 gal flavoured milk (4,040); and 137,072 gal of skim milk receivals (130,000).

Food Technology Section

Short Special Schools.—Apart from the Diploma in Food Technology, short courses were conducted at the College for the Australian food industry.

The 11th Winter School for Food Factory Foremen was held, with a record sixty-one in attendance.

Two other short courses conducted were:

(i) A "Microbiological Quality-Control of Meat" school, in association with the Australian Meat Board. It attracted students from throughout Australia. The limit was twenty students and quickly reached;

(ii) A "Smallgoods Manufacturing" workshop, in association with the Meat and Allied Trades Federation (N.S.W. Division). Again the representation was Australia-wide and the maximum number of places allocated was exceeded because of industry demand.

Processing.—A comprehensive range of products was processed at the School of Food Technology. The processes included canning, dehydration, freezing, curing, and filling. Fruits, vegetables, meats, and dry goods were the raw commodities.

Most of the range of products were produced only on an educational scale, but the following products were produced in quantity for College consumption: 2,600 lb jams, including conserves and fruit butter; 11,190 lb canned preserved fruit; 688 lb dehydrated fruit; 3,250 lb fruit pulp; 5,357 lb canned preserved vegetables; 210 lb dehydrated vegetables; 2,295 lb pickled vegetables; 4,999 lb quick-frozen vegetables; 1,092 pints of soups, sauces, cordials; and 300 lb of miscellaneous items—custard powder, jelly crystals, canned spaghetti, and corn beef.

WAGGA AGRICULTURAL COLLEGE

The Diploma Course

Student Numbers.—The 21st academic year (1969) started with 133 students enrolled. Two withdrew during the year. One hundred and thirty-one attempted final examinations.

Following is a comparative table of enrolments over the past 5 years, including 1970.

	1966	1967	1968	1969	1970
First Year	64	63	47	53	57
Second Year	34	45	45	37	47
Third Year	35	26	43	43	30
Totals	133	134	135	133	134

Diploma Examination, 1969.—Of the 43 Third Year students at the 1969 final examinations, 15 passed. One achieved Honours Class II. Deferred examinations were granted to 24, and 22 of these succeeded. Of the 6 failed students, 3 are repeating Third Year in 1970.

The total of Diploma holders since 1951, the inaugural Diploma year, is now 479, and 37 are Honours Diplomates.

Second Year Final Examinations, 1969.—Of the 37 students, 23 passed at the end-of-year examination. Of the 14 who failed, 5 were granted deferred examination and 4 of these passed. Five of the failed students are repeating Second Year in 1970.

First Year, Final Examinations, 1969.—Of the 53 students enrolled, 2 withdrew during the year. Thirty-six of the 51 students at the end-of-year examination passed at this time. Eleven of the 15 others were granted deferred examination and 7 of the 15 succeeded. No student is repeating First Year in 1970.

The 1970 *Enrolments.*—Of the 57 new students enrolled for First Year in 1970, 1 withdrew voluntarily and 5 because of academic failure. The Second Year class of 47 students includes 5 repeat students. The Third Year class of 30 students includes 3 repeat students.

For 1971 a total of 160 students is anticipated.

The Ex-Students.—The total number of ex-students from March, 1949, the inaugural Year, is now 728:

W.D.A.:	479, including 37 Honours Diplomates.
H.D.A.:	8, including 3 Honours Diplomates.
H.D.A. (Hort.):	4, including 1 Honours Diplomate.
	491, including 41 Honours Diplomates.
Non-Diplomates:	237
Total:	728

Curricula and Staffing.—No significant change was made in the old curriculum. That curriculum will phase out at the end of 1971 when the current (1970) Second Year class has completed the Diploma course.

The new, fully-tertiary unit-based curriculum with associated raised entry standards started at the outset of first term, 1970. The anticipated early difficulties have been overcome.

The College acknowledges indebtedness to the Wagga Technical College for instruction in Woolclassing, Farm Engineering and trade subjects; to Wagga High School for instruction in English Expression, Communication Theory and Practice, and Biomathematics; to Department of Main Roads for instruction in Geology.

The position of Lecturer in Farm Engineering vacant since February, 1968 was filled in December, 1969. In the interim the subject matter was given by staff of the Wagga Technical College. A new position, that of Economics Lecturer, was established and filled. Previously these lectures were given by a seconded officer. Lecturing assistance in the Agronomy discipline was given by staff of the Agricultural Research Institute, Wagga.

New Buildings and Equipment.—The big building programme, started in the previous financial year and continuing, has so far resulted in the handing over of blocks providing 72 bedrooms; also a demonstration shed at the orchard. Packing shed renovations were completed. A new demonstration shed at the sheep section was completed and is about to be handed over. A harvestore was constructed at the new dairy site.

Nearing completion are the new dining room-kitchen complex, and a show barn at the new dairy site. The science laboratory complex is well advanced.

Existing boilers are being adapted to cope with expansion of the College.

The main "ring" road, around the oval, should be completed by August, 1970. Work to complete the second football field and new tennis and basketball areas is well under way.

The programme of major electrical reticulation carried out by the Southern Riverina County Council over a number of years is now virtually completed.

Appointment of an agronomist-in-charge early in 1969 has led to excellent progress in developing the irrigation section. Possible increase of irrigation by a deep bore source of water was investigated, without success. A re-fencing programme at the beef cattle section, involving altered layout, is progressing.

The Commonwealth Grants for Technical Training and Advanced Education enabled further acquisitions of library items, teaching aids, materials, and equipment. Acquisition of further plant and equipment was also possible because of Commonwealth Advanced Education and Consolidated Revenue Funds. The items included a dehydrator, a rotary fruit grader and an air blast sprayer at the orchard, and a pelleting machine for the farm section.

Practical Training.—The College was again indebted to farmers in all districts for their willing, unreserved assistance in whole-farm management studies and general farm operations during student tours, and for providing practical experience during vacations.

Third Year students gained additional practical experience in animal husbandry and stock handling by working as stock attendants at the Wagga and the Sydney Royal Show.

Effects of the change in curriculum, on practical training at the College and on extra-mural training in industry situations, are under discussion. The objective is the type of practical involvement needed as experience for students undertaking the Diploma course under the new curriculum.

Student Tours.—Third Year students made the annual 5-days tour of the central slopes, southern tablelands and south coast regions during October, 1969. Also, half- and one-day visits were made to farm and pastoral properties, to field days, and to Research Stations; variously for farm management surveys, valuation exercises, and to keep up with agricultural research trends.

Extra-curricular Activities.—Four football teams were entered in the Riverina Rugby Football Competition. Rifle and tennis teams competed at the inter-Collegiate contest, at Hawkesbury Agricultural College in August, 1969. Teams were entered in the District Basketball and the District Tennis Association Competition. The cricket team played social matches. Intra-College contests were held in cricket, rugby, billiards, athletics, and swimming.

Debating took place both within the College and against outside organizations in the district. The Student Christian Movement continued to function. A Photographic Club, and recently a Music Club, also provided extra curricular activities.

Short-term Schools and Conferences

A Farm Management school was conducted by the Division of Marketing and Agricultural Economics from 18th to 22nd August, 1969, with 43 farmers and graziers from New South Wales, Victoria, and Western Australia attending. Thirty officers of the Department attended a similar school, for in-serving training, from 18th to 22nd May, 1970.

The 18th Annual Rural Youth School, from 25th to 29th August, 1969 was attended by 29 Rural Youth Organization members. Their theme this year was "Farm Planning and Farm Development for Soil Conservationists".

Farm, Irrigation, Orchard, and Livestock Sections

Farm Section.—Seasonal conditions were generally favourable but a snow fall and frosts in September, 1969 damaged crops slightly.

Considerable carry-over of grain and silage allowed the area sown to cereals to be reduced. Yields were satisfactory: 60,505 bushels of wheat from 185 acres (32·7 bush/acre), 1,860 bushels of oats from 32 acres (58·1 bush/acre) and 2,046 bushels of barley from 53 acres (38·6 bush/acre); 9,956 bushels of grain in all, from 270 acres.

Feed wheat totalling 2,055 bushels was transferred to Hawkesbury Agricultural College, and 228 bushels of seed barley to Hawkesbury Agricultural College and Research Stations. For Foundation Seed production throughout New South Wales 538 bushels of seed barley and 378 bushels of seed wheat were distributed.

Fodder conserved comprised 55 tons of cereal hay, 130 tons of pasture hay, 50 tons of lucerne hay and 200 tons of silage. An additional grain silo, 1,900 bushels capacity, was built and a hay-shed extended to increase fodder storage.

Fencing improvements included replacement of 40 chains of old boundary fence, and construction of 240 chains of sub-division fences. Area of arable land was increased by clearing 40 acres of natural pasture land and sowing it with a cereal grazing crop.

Some major items of equipment purchased were 2 tractors, a self-propelled header, hay-baler and a forage carrier. A mini-moke and a station sedan were added to the vehicle strength.

Irrigation Section.—Redevelopment of the irrigation sections continued, for improved instruction and experience of students in the agronomic aspects of irrigation and design. Maize, grain sorghum, fodder sorghum, sunflower, and small areas of cotton were some of the crops planted and harvested in the section.

Improved supply of river water to meet additional needs, for irrigation and the new dairy, are being investigated.

About 20 acres of annual pastures and 12 acres of lucerne have been planted on re-developed, re-designed lands on the extreme southwest boundary of the College.

Orchard Section.—Steps were taken to develop the old cannery *cum* packing shed into a relatively modern packing shed. Besides the re-construction activities, a rotary fruit grader (8 bin) was installed, with roller conveyors and a refrigerated room. For easy movement of fruit a manual fork lift was acquired. Also, fluorescent lighting was installed.

A small dehydrator for either parallel or counter-flow drying was installed to handle the prune crop. It can dehydrate a ton of fresh fruit per 24 hours.

Bulk handling can now be demonstrated. A 2-bin bulk trailer and six 20 bushel bulk-bins were acquired for this. The fork lift will be used in conjunction, in the packing shed.

A Demonstration Unit building, 60 ft by 30 ft, was built, but the Orchard Section's office is now also in this new building. So too are the store room, amenities and ablution facilities.

Horse Section.—At 31st May, 1970, there were 59 head (5 entires, 33 mares, 6 geldings, and 15 foals), compared with 56 a year earlier.

Sales comprised an Arab colt at $600; 9 Arab females that were sold at auction for a gross of $18,900. Transfers comprised a gelding to Temora Agricultural Research Station, and the Arab stallion "Cynasa" (imp) to Hawkesbury Agricultural College. Services to privately-owned mares during the 1969 breeding season comprised 13 original and 3 free return services, yielding $975 for services and $345 for agistment.

Competitive exhibits at the 1970 Sydney Royal Show from the Arab horse stud gained 1 Second, 1 Third, 1 Fourth, and 2 Fifth prizes for the Arab team.

Beef Cattle Section.—At 31st May, 1970, there were 91 head in the stud (20 bulls, 71 cows), compared with 85 a year earlier. There were also 88 head in the grade herd (12 steers, 76 cows) compared with 36 a year earlier. Sales comprised a stud bull, for $400; 20 steers and 7 cows; and 2 cull Poll Shorthorn bulls sold for slaughter. Also, 8 cull dairy animals were sold.

On transfer, 42 Angus females were received from Trangie Agricultural Research Station, and 2 Poll Shorthorn cows and a Brahman cross heifer from Hawkesbury Agricultural College.

On loan, 2 Murray Grey sires were received from the Murray Grey Beef Cattle Society of Australia. These were mated to 42 Angus females before being returned to their owners. It marked the start of the "W.A.C." Murray Grey stud based at the College.

Sheep Section.—Replacement of aged animals with young stock has restored the flock numbers to the pre-drought level of 1,900.

Flock structure has been re-organized. Demonstration projects appropriate to the commercial practices in the region have been initiated. Further decentralizing of sheep handling facilities has proceeded.

Dairy Section.—High production was maintained, helped by the favourable 1969 winter and spring. Fifty cows completed test for an average of 8,254 lb milk, 4·9 per cent test and 411 lb butterfat. These results do not include the "Demonstration Herd" wherein an example of notable production is the 17,820 lb milk, 3·9 per cent test, and 697 lb butterfat from the Friesian "Hawkesbury Thio Belfrette II".

Sales of stock comprised 8 stud bulls, for $1,430; 37 head of cull cattle including 29 "bobby" calves, for $932; and 5 cows and a calf from the commercial herd, valued at $500. Also, 2 Australian Illawarra Shorthorn heifers were donated to the Society for Relief in India and South-East Asia; the Pakistan Project.

Sales of milk and cream (including the anticipated sales for June, 1970) grossed in excess of $15,000.

Plans and specifications are nearing completion for calling of tenders for erection of the new dairy, feed stalls, bull sheds, office demonstration unit, and calf feeding yards.

In the herd improvement programme the first of the daughters of the bulls "Bemersyde Dream Jester" and "Wagga Rose Liberator 3rd" have come into production but it is still too soon to judge the worth of these bulls. Continuing use is being made of the imported sire "The Mounts Orange Boy" through artificial insemination, together with limited matings to "Francliff Ensign".

Overall, type of animal in the herd has improved and many of the cows on their first calf could develop into excellent type and production animals.

The College entered a large team at the Wagga Show and a small team at Sydney Royal Show. Results at Wagga were pleasing and although at Sydney no award was won the team made a good exhibit.

Pig Section.—At 1st July, 1969, there were 119 head, and during the year 250 pigs were born. Of the 369 head, 34 were killed for food, 205 were marketed, 6 were sold for stud, and 60 were stillborn or died or were destroyed. At the close of the 12 months 64 pigs were on hand.

Two student projects concerned with protein supplements and one with use of oats in the diet of growing pigs were conducted.

Poultry Section.—The future of this Section being in doubt, developments this year were very limited. The small purebred breeding flock and also turkey production were discontinued. The egg laying and meat production units were run commercially.

YANCO AGRICULTURAL COLLEGE AND RESEARCH STATION

Research and Allied Technical Work

The research and allied technical work at the Station is staffed by officers of the Divisions of Plant Industry, Horticulture, Animal Industry and Dairying, and the Biological and Chemical Research Institute (former Division of Science Services). Their work has been appropriately incorporated within those Divisional and Institute sections of this Report of the Department.

Agricultural Education and Training

THE FARM CERTIFICATE COURSE

Student Numbers in 1969, *and the Examinations*.—Of the 101 students enrolled for the 1969 1-year Farm Certificate Course, 6 withdrew before the final examinations. Of the 95 candidates, 78 were successful—including 7 who were granted deferred examination.

Evaluation of the 1969 *Academic Year*.—This was one of the most successful in the history of the College. The percentage of passes was the best to date and, more importantly, student attitudes to all phases of College life were excellent. This engendered a superior climate for work and study, and students seemed to gain more from the course than did their predecessors. At least in part this was because of the extra maturity of a significantly larger number of students in 1969. Their example and leadership set a pattern for the year as a whole and provided further evidence of the wisdom of insisting on 'older' students, with some experience in agriculture as a pre-requisite for entry to the College.

Changes in Structure of Course.—Since its inception, there have been gradual changes in the course structure. These have modified the overall objectives of the course, and the teaching methods. The main changes may be summarized as:

- less emphasis on farm practical work;
- greater emphasis on the Farm Management discipline;
- grouping of subjects into disciplines, and the forming of discipline committees to control these—to achieve better co-ordination throughout the Course material;
- development of an examination system that emphasises relationships between the various subjects in the discipline and between the disciplines;
- much more emphasis on the student Farm Development Plan; especially on the economics content of this exercise.

Those changes are giving the course a greater bias towards practical farm management training, with stress on the principles and concepts underlying the business facets of farming.

The changes have been well received by students. There is a more notable atmosphere of learning, with more onus placed on the student. Certainly the course is more difficult academically, but the standards set do not yet seem too high—an aspect that will be closely watched.

THE PROJECTED IRRIGATION CERTIFICATE COURSE

Inauguration of this Course has been postponed until 1971. Provided a competent lecturer in Irrigation Engineering is recruited, the Course should start in 1971.

BUILDINGS AND EQUIPMENT

No further progress has been made on the Animal Husbandry Complex for student instruction. The new Heath Accommodation Block is now occupied. It houses 50 students.

Major items of equipment acquired this year as teaching aids were spray irrigation systems, projectors, and other visual aids, agricultural machinery, and various types of motors.

C. B. ALEXANDER AGRICULTURAL COLLEGE, "TOCAL" PATERSON

Departmental Administration, from 1st January, 1970

Following negotiations with the Presbyterian Church Trustees and the Trustees of the Estate of the late C. B. Alexander, responsibility for administration of this College was handed over to the Minister for Agriculture on 1st January, 1970.

A Farming and Grazing Property

The College property of 5,133 acres is used mainly for beef cattle and dairy production. Currently it is capable of carrying about 1,000 head of beef cattle and 200 head of dairy cattle. Livestock handed over to the Department of Agriculture on 1st January, 1970, included 727 beef cattle, 212 dairy cattle, and 19 stock horses.

The Enterprises

A Milk Board quota, 205 gallons per day, is met by a herd comprising mainly Friesians. The beef-breeding enterprise is based on a Poll Hereford herd; currently 260 cows. Other beef activities include steer fattening and vealer production. The property offers vast scope for development and this is extremely valuable for the training of students.

Educational Objectives

Following the system established when the College was founded in 1965, students have opportunity to pursue studies over 2 years. A Certificate in Agriculture is awarded to successful students after 1 year, and an Advanced Certificate is available after a second year.

In their practical work the students are involved in all of the tasks of land development, fencing, yard construction, etc., as well as pasture, crop, and animal husbandry.

Student Accommodation and Numbers

The accommodation provides for 92 students. Enrolment numbers per year, from 1965 to 1970, have been as follow:

Course Year	1965	1966	1967	1968	1969	1970
First Year	15	44	45	48	39	45
Second Year	Nil	14	39	29	31	24
Total	15	58	84	77	70	69

Research Potential

Preliminary discussions have been held regarding possible use of "Tocal" resources as a base for research to serve the Mid-Coast and Hunter Region.

APPENDIX I

ACCOUNTS OF THE DEPARTMENT OF AGRICULTURE FOR THE YEAR 1969/70

The cost of maintaining the Department of Agriculture is met from the Consolidated Revenue Fund, whilst capital expenditure on buildings and permanent improvements to departmentally owned property is a charge on the General Loan Account.

In addition to the foregoing sources of funds, the Department is assisted in financing certain specified lines of research and development, together with the control of insect pests and animal diseases, by levies on industry and by grants from the Commonwealth, semi-Governmental, and public and private organizations. Operations in this category are reflected in a large number of accounts within the classification of "Special Deposits" accounts, some details of which are given later in this Appendix.

COMPARATIVE STATEMENT OF EXPENDITURE

Account	1968–69	1969–70	Increase or Decrease
	$	$	$
Consolidated Revenue Fund	16,377,276	17,612,441	1,235,165 (Increase)
General Loan Account	756,148	1,520,000	763,852 (Increase)
	$17,133,424	$19,132,441	$1,999,017 (Increase)

EXPENDITURE FROM CONSOLIDATED REVENUE FUND

The following tabulation provides a comparison of the expenditure from Consolidated Revenue Fund by the functional Divisions of the Department for the last 2 financial years:

Division	1968–69	1969–70	Increase or Decrease
	$	$	$
Central Administration (a)	4,005,089.25	3,675,833.59	329,255.66 (Dec.)
Science Services	587,680.51	711,786.78	124,106.27 (Inc.)
Plant Industry	836,621.42	946,563.72	109,942.30 (Inc.)
Horticulture	772,882.78	871,789.72	98,906.94 (Inc.)
Dairying (b)	1,263,253.06	1,445,770.28	182,517.22 (Inc.)
Hawkesbury Agricultural College	734,834.05	803,409.16	68,575.11 (Inc.)
Wagga Agricultural College	449,202.32	492,043.28	42,840.96 (Inc.)
Research Stations	1,587,463.93	1,965,310.64	377,846.71 (Inc.)
Animal Industry—			
Head and District Offices	2,803,537.03	3,129,914.59	326,377.56 (Inc.)
Queensland Border	292,718.32	331,912.23	39,193.91 (Inc.)
Tick Quarantine Areas	2,466,735.20	2,601,751.08	135,015.88 (Inc.)
Royal Botanic Gardens	577,258.41	636,355.57	59,097.16 (Inc.)
	$16,377,276.28	$17,612,440.64	$1,235,164.36 (Inc.)

	1968–69	1969–70
	$	$
(a) Includes Drought Relief Measures—Cartage on fodder, transport subsidies, &c.	1,019,083.65	27,703.83
(b) Includes Assistance to North Coast Dairying Industry	500,000.00	600,000.00
	$1,519,083.65	$627,703.83

The amounts provided for assistance to the North Coast Dairying Industry were carried to Special Deposits Accounts (No. 99) "North Coast Dairy Feed Year Assistance Scheme", comment on which appears later in this appendix under that section dealing with Special Deposits Account.

EXPENDITURE FROM GENERAL LOAN ACCOUNT

Expenditure from the General Loan Account for the year ended 30th June, 1970, was $1,520,000.

Details of the expenditure are as follows:

	$
Advanced Education—	
Capital Works financed from State and Commonwealth Allocations (State contribution)	500,000.00
C. B. Alexander Agricultural College—	
Expenses on acquisition	150,000.00
Construction of Cottage	17,000.00
Queensland Border—	
Barringun—Construction of Cottage	16,500.00
Bonanga—Construction of Cottage	16,500.00
Hebel—Construction of Cottage	16,500.00
Cudgel Demonstration Farm—Yanco—	
Construction of Cottage	15,000.00
Royal Botanic Gardens—	
Exhibition Glasshouse	120.82
Hawkesbury Agricultural College—	
Construction of Cottage	15,000.00
Construction of Cottage	17,000.00
Wagga Agricultural College—	
Construction of Cottages (2)	29,000.00
Alstonville Tropical Fruit Research Station—	
Cottage	4,800.00
Extension to Office Accommodation	43,771.29
Condobolin Agricultural Research Station—	
Construction of Foreman's Store	10,974.31
Laboratory and Administration Building	28,223.26
Machinery Shed	10,762.00
Dareton Horticultural Research Station—	
Alternative Irrigation Water Supply	34,759.77
Construction of Cottage	15,000.00
Narrabri Agricultural Research Station—	
Acquisition of Land	200,000.00
Orange Agricultural Research Station—	
Construction of Cottage	17,000.00
Seven Hills Poultry Research Station—	
Broiler Houses	37,143.28
Construction of Cottage	14,000.00
Laboratory and Administration Building	58,856.79
Tamworth Agricultural Research Station—	
Construction of Cottage	2,200.00
Breeza Sub-Station near Tamworth—	
Construction of Cottage	15,000.00
Trangie Agricultural Research Station—	
Construction of Cottage	16,000.00
Irrigation Development—Stage I	39,891.55
Wollongbar Agricultural Research Station—	
Power Reticulation, &c.	35,737.00
Growing Shed (Pigs)	19,597.05
Research Laboratory	38,334.80
Yanco Agricultural Research Station—	
Construction of Cottage	15,000.00
Glenfield Veterinary Research Station—	
Construction of Cottage	15,000.00
Laboratory and Conference Room	54,424.50
Steam Raising Plant and Autoclaves	903.58
	$1,520,000.00

OTHER ACCOUNTS

Special Deposits Accounts

Following is a complete list of accounts and funds within the Special Deposits Account at the Treasury on which this Department operates:

Name of Account	Balance as at 1st July, 1969	Receipts 1969–70	Payments 1969–70	Balance as at 30th June, 1970
	$ Cr.	$	$	$ Cr.
Advances to Officers for purchase of Motor Cars	Dr. 220,890.41	122,303.14	132,776,68	Dr. 231,363.95
Potato Growers' Licensing Act, 1940	1,221.71	4,972.06	5,340.00	853.77
Commonwealth-State Flood Relief Scheme, 1964	50,035.34	....	....	50,035.34
Advanced Education—Capital Works financed from State and Commonwealth allocations	6,892.85	1,021,868.00	964,727.85	64,033.00
Balance of Salaries Adjustment Suspense Account	347,178.02	412,760.64	347,178.02	412,760.64
Commonwealth-State Bush Fire Relief Scheme, 1968	101,296.67	....	22,671.73	78,624.94
Bega Dairy Demonstration Farm—Working Account	....	382.95	....	382.95
Government Printing Office—Working Account and Stores Account and sale of Publications	....	3,109.86	....	3,109.86
North Coast Dairy Feed Year Assistance Scheme	87,213.73	600,000.00	583,309.36	103,904.37
Noxious Insects Destruction Account	238,330.34	384,238.31	93,469.16	529,099.49
Swine Compensation Fund	684,161.17	104,175.53	19,888.62	768,448.08
Treasury Fire Risks—Cottage, Bonshaw Crossing, Queensland Border	....	....	17,665.00	Dr. 17,665.00
Treasury Fire Risks—Division of Science Services, Rydalmere	Dr. 531.52	542.44	10.92	....
Commonwealth Grant—State Secondary School and Technical Training Projects financed under States' Grants (Technical Training) Act, 1965	76,198.96	634,300.00	745,705.27	Dr. 35,206.31
C. B. Alexander Agricultural College Working Account	....	230,593.06	173,763.29	56,829.77
Hawkesbury Agricultural College Canning Factory Account	2,210.86	3,458.79	2,428.37	3,241.28
Bush Fire and Flood Relief Account (State)	25,787.20	....	6,631.31	19,155.89
Hawkesbury Agricultural College—Dairy Factory Working Account	85,315.60	351,538.35	362,017.59	74,836.36
Tobacco Industry Trust Account	15,900.91	40,022.50	44,310.50	11,612.91
Pasture Control Account	20,082.74	33,659.64	53,431.50	310.88
Commonwealth Government Grant for Acquisition of Library Materials in terms of the States' Grants (Advanced Education)	2,171.25	2,680.00	3,628.41	1,222.84
Daily Telegraph TCN 9 Bush Fire Relief Fund	14,350.97	....	900.00	13,450.97
French Bean Seed Marketing Board of New South Wales—Funds upon Dissolution Account	116.11	....	116.11	....
Potato Marketing Board of New South Wales—Funds Upon Dissolution Account	47.32	....	47.32	....
Unclaimed Moneys Account	1,351.98	2,287.84	1,169.10	2,470.72
Commonwealth Extension Services Grant	86,026.23	1,367,822.23	1,286,363.25	167,485.21
Cattle Compensation Fund	1,841,810.96	426,616.84	310,622.90	1,957,804.90
V. P. Bragg Scholarship—Wagga Agricultural College	17.69	647.00	664.69	....
Wagga Agricultural College Swimming Pool Account	1,034.23	1,302.00	397.93	1,938.30
Wheat Industry Stabilization Fund (Disposal) for Research and Extensions in the Wheat Industry	13,311.28	1,350.00	7,119.26	7,542.02
V. P. Bragg Scholarship Account (Investment)	12,000.00	....	....	12,000.00
Wheat Industry Stabilization Fund (Disposal) for Research and Extension in the Wheat Industry—Investment Account	30,000.00	....	....	30,000.00
Purchase of Stock for the Control of Pastures at Condobolin Agricultural Research Station	....	....	12,000.00	Dr. 12,000.00
Triennial Election of Producers Representatives to Citrus Fruits (excluding Lemons) Marketing Board of the Wentworth Shire and that portion of the Balranald Shire within the County of Taila	....	....	60.90	Dr. 60.90
Triennial Elections of Lemon Marketing Board for the State of New South Wales	Dr. 259.36	304.76	45.40	....
Triennial Election of Producers' Representatives to the Wine Grapes Marketing Board for the Shires of Leeton, Wade, and Carrathool	Dr. 81.23	81.23	....	....
Advance by U-DALS for employment of casual labour at Wollongbar Agricultural Research Station	36.41	228.77	244.41	20.77
Advance for destruction of banana plants on property of R. Proctor, Bowraville	....	1,000.00	....	1,000.00
Advance for purchase of peat cultures	Dr. 29.00	179.00	157.54	Dr. 7.54
C. B. Alexander Agricultural College—Trust Account	....	2,450.33	618.70	1,831.63
Apple and Pear Spray Residue Committee—Employment of Fruit Inspector	16.63	....	....	16.63
Australian Cotton Research Conference	41.00	....	41.00	....

Special Deposits Account—*continued*

Name of Account	Balance as at 1st July, 1969	Receipts 1969–70	Payments 1969–70	Balance as at 30th June, 1970
	$ Cr.	$	$	$ Cr.
Australian Dairy Produce Board—Grant for Research Projects—				
Dairy Detergency	....	3,157.50	3,106.12	51.38
Expansion of other Pasture and Animal Research	729.35	6,900.00	7,910.98	*Dr.* 281.63
Farm Management Economics in North Coast Dairying	6,483.25	6,000.00	10,487.06	1,996.19
Flood Irrigation Research, Mooneba	571.75	....	571.75	....
Mastitis Research and Control	297.62	900.00	1,123.55	74.07
Pasture Improvement	....	3,000.00	4,000.00	*Dr.* 1,000.00
Pasture Species Research	6,800.46	13,000.00	18,127.42	1,673.04
Problems Associated with the Manufacture and Keeping Qualities of Process Cheese	2,304.93	6,825.00	10,316.45	*Dr.* 1,186.52
Recombining Unit—Hawkesbury Agricultural College	2,851.15	....	2,851.15	....
The Influence of Seasonal Variations on the Compositional Quality of Skim Milk on the Physical and Chemical Qualities of Spray Dried Skim Milk Powder	*Dr.* 379.80	....	875.44	*Dr.* 1,255.24
The Relationship between Chemical Composition and Cheese Grading	....	2,760.00	1,248.18	1,511.82
Visit to South East Asian Recombining Plants	....	1,200.00	1,196.17	3.83
Australian Dairy Produce Board—Wilson, B. R.—Post-Graduate Scholarship	....	2,000.00	2,000.00	....
Australian Meat Research Committee—				
Beef Feed Year Pastures—North Coast	12,290.35	22,274.40	23,221.61	11,343.14
Major and Minor Element Deficiencies in Soil from Beef Areas	757.60	....	564.86	192.74
Fertilizer Requirements for Pasture Production on North Coast Soils	2,949.81	15,830.97	14,414.03	4,366.75
Winter Nutrition on Northern Tablelands	1,733.15	7,707.56	7,729.98	1,710.73
Nature and Organisation of the Australian Beef Cattle Industry	1,070.52	7,067.81	5,451.03	2,687.30
Beef Cattle Improvement through Breeding Methods	*Dr.* 322.13	26,432.62	22,724.75	3,385.74
Incidence, Importance and Control of Parasites of Cattle in New South Wales	2,753.49	10,203.37	12,326.24	630.62
Bloat Research	241.77	8,000.00	6,570.61	1,671.16
The Biological Study of Drought and Supplementary Feeding of Sheep	....	92,000.00	84,977.25	7,022.75
Sheep Fertility Service	2,290.55	16,585.20	22,739.83	*Dr.* 3,864.08
Regional Economic Studies of Mutton and Lamb Production	7,051.64	3,575.00	2,967.96	7,658.68
The Evaluation of Selection and Management Practices in terms of Carcass Characteristics	549.45	7,478.22	4,666.71	3,360.96
Facilities for Carcass Investigations	....	21,500.00	17.16	21,482.84
Evaluation of Pasture and Forage Species in terms of Animal Production in the Northwest	....	2,050.00	761.42	1,288.58
Integration of Crop and Animal Production	....	8,330.00	5,800.00	2,530.00
Australian Potash Research Institute Grant—Investigation into Potassium Status of New South Wales Soils	100.62	....	100.62	....
Banana Research Committee—Grant for Research—				
Packaging	480.82	....	84.42	396.40
Ripening	615.23	....	53.36	561.87
Transport	355.31	....	355.31	....
Pre-cooling	21.41	78.59	....	100.00
Staff and Travelling	55.77	10,367.92	8,221.15	2,202.54
Brown Rot Investigations—Trust Fund	226.92	....	226.92	....
Commonwealth Grant—Milking Machine Components Testing Station	410.12	1,843.44	2,118.78	134.78
Contribution by Arnotts Biscuits Pty Ltd, towards Breeding of Improved Wheat Varieties in Irrigation Areas	8,000.00	....	....	8,000.00
Contributions by Auscott Pty Ltd, for Cotton Research in the Namoi Valley	315.04	1,498.25	249.60	1,563.69
Contribution by Australian Bean Research Group and Commonwealth for Bean Disease Research	....	2,300.00	....	2,300.00
Contribution by Australian Mushroom Growers' Association and Commonwealth for Research into Mushroom Diseases	4,751.19	5,708.00	6,962.12	3,497.07
Australian Wool Board Grants—				
Adaptive Pasture Research—Southern Tablelands	4,402.34	13,960.00	15,825.24	2,537.10
Aerial Control of Serrated Tussock—Southern Tablelands	530.99	1,025.00	1,242.78	313.21
Aerial Sowing of Pastures	194.49	71.26	265.75	....
Co-operative Research into Treatment of non-arable Areas—Serrated Tussock Control	599.60	800.00	1,065.50	334.10
Comparison of the Lifetime Performance of Single and Twin Born Merino Ewes	140.10	1,500.00	1,312.38	327.72

Special Deposits Account—*continued*

Name of Account	Balance as at 1st July, 1969	Receipts 1969–70	Payments 1969–70	Balance as at 30th June, 1970
	$ Cr.	$	$	$ Cr.
Australian Wool Board Grants—(cont.)				
Development and Use of Various Biochemical Parameters in Diagnosis	4,181.00	800.00	4,735.26	245.74
Development of Aerial Pasture Improvement Techniques for the Northern Tablelands of New South Wales	....	9,100.00	4,313.95	4,786.05
Development Project for the High Rainfall Region of South Eastern Australia	171.65	96.78	268.43	....
Efficiency of Wool Production	1,989.12	22,620.00	6,860.73	17.748.39
Farm Management Problems of Development in the Yass Valley	254.02	8,752.08	7,351.02	1,655.08
Fleece Measurement for Selection Stud Merino Rams—Fees	259.00	2,981.92	2,650.42	590.50
Fleece Measure for Selection of Stud Merino Rams	7,009.70	20,684.87	26,218.10	1,476.47
Fodder Conservation—Northern Tablelands	425.12	5,430.00	5,013.33	841.79
Forage Ecology—Research Agronomists Training with Division of Plant Industry, CSIRO, Canberra	840.17	9,750.00	9,588.83	1,001.34
Forage Crops—Northern Tablelands	302.86	5,550.00	5,002.14	850.72
Comparison of Management Systems	*Dr.* 926.93	5,118.00	2,072.99	2,118.08
Interactions between Species, Nutrients, Soils—Southern Tablelands	1,390.29	5,230.00	5,870.60	749.69
Pasture/Animal Production Study	484.07	5,267.00	5,102.93	648.14
Pasture Research—Cool Wet Areas—Southern Tablelands	3,645.18	5,890.00	5,524.25	4,010.93
Physiology of Pasture Seeds	186.64	56.01	242.65	....
Post Partum Mating of Sheep	*Dr.* 2,591.93	25,910.00	9,256.90	14,061.17
Post-Graduate Scholarship—M. H. Campbell	....	2,800.00	2,800.00	....
Post-Graduate Scholarship—B. A. Hamilton	58.00	2,800.00	2,858.00	....
Post-Graduate Scholarship—P. J. Holst	856.00	2,833.20	3,689.20	....
Post-Graduate Scholarship—I. D. Killeen	800.00	60.00	860.00	....
Post-Graduate Scholarship—M. V. Petruchenia	....	866.00	866.00	....
Post-Graduate Scholarship—G. E. Robards	....	2,800.00	2,800.00	....
Post-Graduate Scholarship—R. J. Roughley	94.10	555.66	149.76	500.00
Post-Graduate Scholarship—A. J. Williams	117.00	....	117.00	....
Study of some Factors Influencing Efficiency of Root Nodule Bacteria	*Dr.* 544.21	1,350.00	805.79	....
Study of Factors Limiting Pasture Yield	202.02	119.09	321.11	....
The importance of the Ram in Flock Reproduction Performance	4,419.59	4,369.00	8,415.82	372.77
The Productivity of Natural Annual Pastures at Trangie with and without Supplementary Areas of Lucerne or Natural Perennial Grasses	903.60	600.00	978.91	524.69
Research Agronomist R. A. Woodward—Training in Forage Ecology with CSIRO	....	2,540.00	1,742.22	797.78
Research into Control of Insecticidal Resistance in Sheep Blowfly	40.59	10,748.17	10,209.88	578.88
Purchase of X-ray Spectrograph and Diffractometer	15,753.63	....	3,471.80	12,281.83
Sheep Breeding and Pasture Management—Relative Efficiency at Several Stocking Rates and Superphosphate Levels	5,961.26	15,110.00	12,445.70	8,625.56
Skin Folds and Ram Fertility	286.50	....	....	286.50
Study of Factors Influencing Nodulation of Legumes, Survival of Rhizobia in Soil and Effectiveness of Rhizobia Strains	....	64,790.00	1,034.70	63,755.30
The Effect of Pasture Management and Time of Lambing on Wool and Lamb Production in the Southwest Wheat Belt of New South Wales	831.09	2,290.48	536.80	2,584.77
The Influence of Rates of Stock and Superphosphate Applications on the Productivity of Merino Ewes Grazing on Improved Annual Pastures	199.22	....	199.22	....
Training of Livestock Research Officers	61.51	....	61.51	....
Training of Research Agronomist via a Study of Autecology of Galvanized Burr (Bassia Birchii) in Northwestern New South Wales	....	3,115.00	....	3,115.00
Training of Research Agronomist via a Study of the Ecology of Annual Weeds of Pastures	....	2,315.00	....	2,315.00
Contribution by Australian Wine Board—Overseas visit R. E. Smart	....	1,550.00	1,550.00	....
Contribution by CSIRO towards Overseas Visit—D. J. McGillivray	....	727.66	727.66	....
Contribution by Industry towards Research into Meatmeal Quality at Seven Hills Poultry Research Station	10.82	....	10.82	....
Contribution by Jensen-Salsbery Laboratory for Dairy Detergency Research	....	3,000.00	1,798.14	1,201.86
Contribution by Murray Grey Beef Cattle Society for Cattle Breeding	....	500.00	381.25	118.75

Special Deposits Accounts—*continued*

Name of Account	Balance as at 1st July, 1969	Receipts 1969–70	Payments 1969–70	Balance as at 30th June, 1970
	$ *Cr.*	$	$	$ *Cr.*
Contribution by Rice Industry Co-ordination Committee and Commonwealth for Rice Research	....	30,000.00	....	30,000.00
Contribution by States towards salary and expenses of Patrol Officer—Grasshopper Control (Australian Plague Locust Patrol Service)	4,707.18	8,500.00	6,410.03	6,797.15
Contribution by Central Coast Agricultural Research and Extension Committee for Research into Citrus Rind Blemish	....	2,000.00	....	2,000.00
Contribution to Animal Insect Pest Investigations—Glenfield Veterinary Research Station	359.85	....	....	359.85
Board of Tick Control Employees' Proportion of Contributions to Local Government Superannuation Scheme	15,568.94	42,201.40	51,889.04	5,881.30
Contributions toward Development of Tamworth Experiment Station	1,350.23	....	....	1,350.23
Department of Agriculture Suspense Account	85,984.39	743,953.88	747,780.19	82,158.08
Donation by A.C.F. and Shirley Fertilizers, Ltd—Purchase of Fertilizer	136.00	1,413.20	1,549.20	....
Donation by Merck, Sharp, and Dohme Aust. Pty Ltd, for Banana Research	....	200.00	116.20	83.80
Donation from Austral Pacific Fertilizers for Purchase of Urea	....	231.38	231.38	....
Geigy Agricultural Chemicals Contribution towards Weedicide Research Project at Hawkesbury Agricultural College	200.00	....	200.00	....
Grant by Australian Apple and Pear Board for Co-operative Programme with CSIRO on Pest Management in Pome Fruit Orchards	4,447.76	....	2,093.81	2,353.95
Grant by Co-operative Bud Selection Society Ltd, towards Establishment of Citrus Mother Tree Block	12.02	....	5.40	6.62
Grant from Council of Egg Marketing Authorities of Australia for Development of a Pathogen-free Flock	....	3,000.00	....	3,000.00
Grant from Council of Egg Marketing Authorities of Australia on Evaluation of Supply Control Measures in the Egg Industry	....	2,075.00	2,035.64	39.36
Grant by Council of Egg Marketing Authorities—Pesticide Residue in Eggs	....	1,125.00	....	1,125.00
Hawkesbury Agricultural College—Egg Laying Competition Prize Fund	3,459.18	2,223.50	3,525.25	2,157.43
Hawkesbury Agricultural College—Trust Account	13,105.09	11,551.33	16,096.27	8,560.15
Herd Recording—Working Account for Purchase and Re-sale of Brackets and "U" Bolts	....	2,430.68	1,795.71	634.97
Manning District Agricultural Research Council Contribution for Pasture Research in the Manning District	*Dr.* 706.98	5,450.00	3,531.20	1,211.82
Navy Bean Marketing Board—Surplus Funds	145.46	....	19.75	125.71
Payments by Commonwealth to Egg Marketing Board of New South Wales	....	5,175,988.82	5,175,988.82	....
Pender W. S. Memorial Fund—Interest on Bonds	453.49	118.00	....	571.49
Reserve Bank of Australia—Grant from Rural Credits Development Fund for Dairy Farm Development on Alluvial and Chocolate Basalt Soils in Richmond Valley	1,093.62	....	....	1,093.62
Reserve Bank of Australia—Grant from Rural Credits Development Fund towards Whole Farm Feed Year Studies on Red Basalt Soils	994.30	....	386.72	607.58
Rohan Jones, W.—Secondment to University of New England	....	6,000.00	4,343.81	1,656.19
Salaries Refund Suspense Account	....	3,239.20	3,239.20	....
Scholarship — D. J. McDonald — Douglas Mackellar Award—Rice Industry Co-ordination Committee	2,000.00	2,000.00	2,000.00	2,000.00
Shannon Vale Nutrition Station Working Account	33,995.22	9,129.51	14,443.72	28,681.01
Skeleton Weed Research—Grant by Technical Sub-Committee for Salary of Technical Assistant	91.71	55.38	147.09	....
South Coast Agricultural Research and Extension Council—Contribution towards Research	2,054.88	6,335.00	5,009.68	3,380.20
The Sulphur Institute of U.S.A.—Grant for Compilation, &c., of Results of U.P.S.E.T. Trials	1,590.70	....	....	1,590.70
Tropical Fruit Research Station—Donation by Banana Growers' Federation	3,812.46	....	....	3,812.46
Tobacco Extension Grant to Finance additional Extension Work	401.16	....	144.60	256.56
Unclaimed Salaries and Wages	2,300.29	3,785.36	4,657.07	1,428.58
Unemployment Relief in Drought Areas, 1968	307.63	....	307.63	....
Visit by Dr J. K. A. Bleasdale for Australian Agricultural Research Conference	....	2,485.00	2,485.00	....

Special Deposits Account—*continued*

Name of Account	Balance as at 1st July. 1969	Receipts 1969–70	Payments 1969–70	Balance as at 30th June, 1970
	$ Cr.	$	$	$ Cr.
Wagga Agricultural College—Trust Account	2,768.97	7,612.50	7,598.13	2,783.34
Wheat Industry Research Committee of New South Wales—Grants—				
A Study of Fertilizer Nitrogen Reactions in Wheat Belt Soils—Wagga	766.24	....	727.00	39.24
Breeding of Improved Wheat Varieties for Irrigation Areas	6,776.47	....	3,038.37	3,738.10
Brownlee H.—Attendance at Grasslands Conference	....	200.00	50.00	150.00
Continuous Cropping in Southern New South Wales	....	13,575.00	10,612.85	2,962.15
Contribution of Legumes to the Productivity of Wheat Soils in Northern New South Wales	726.76	3,600.00	3,383.33	943.43
Controlled Environment Chamber for Frost Research	59.90	....	311.82	*Dr.* 251.92
Critical Levels of Soil Nitrogen in Southern Wheat Belt	1,532.23	8,942.11	6,105.91	4,368.43
Electronic Grain Counter	600.00	....	384.46	215.54
Equipment for Breeding for Frost Resistance	....	10,250.00	31.90	10,218.10
Extensions — Laboratories, Agricultural Research Institute, Wagga	6,774.08	1,433.75	....	8,207.83
Genetic Analysis of Physiological Components of Maturity of Wheat	*Dr.* 255.99	7,455.00	6,027.26	1,171.75
Growth, Development and Yield of Wheat Varieties in Relation to date of Sowing and Environment	9,657.67	10,000.00	12.90	19,644.77
Investigation of Black Soil Scarab	286.13	....	....	286.13
Laboratory Equipment—Wagga Agricultural Research Institute	141.29	....	....	141.29
Pilot Regional Testing Service for Phosphorus on Wheat	1,256.14	5,700.00	5,773.18	1,182.96
Soil Factors Associated with Nutrient Deficiencies in Wheat	*Dr.* 120.67	8,650.00	4,520.55	4,008.78
Soft Wheat Quality Programme—Central West	2,328.34	....	2,319.46	8.88
Wheat Research in the Central West	24,576.31	35,030.00	70,423.26	*Dr.* 10,816.95
Wheat Industry Research Council Grants—				
Australian Wheat Collections	1,786.26	16,317.07	15,411.74	2,691.59
Critical Levels of Soil Nitrogen in the Southern Wheat Belt	384.94	870.00	1,254.94	....
Economics of Segregation and Storage of Wheat	552.40	....	552.40	....
Growth, Analysis of Wheat in Relation to Development and the Natural Environment	442.74	4,471.32	4,486.64	427.42
Equipping of Sub-station for Wheat Research	4,401.00	12,600.00	12,000.00	5,001.00
Importance of Grazing Lucerne Varieties for Wheat Belt Soils and Testing of Phalaris Tuberosa	5,283.78	....	5,283.78	....
Importation of Norwegian Drill and Austrian Auto-header	1,757.21	1,750.00	91.62	3,415.59
Improvement of Durum Wheat Varieties	1,266.07	5,123.00	9,934.77	*Dr.* 3,545.70
Investigation into Possibilities of Segregation of Wheats on the Basis of Quality—Wheat Grading Survey	1,698.58	....	....	1,698.58
Laboratory Equipment—Agricultural Research Institute, Wagga	1,995.86	....	202.60	1,793.26
Overseas Visit (Travel)—H. Marcellos	971.00	....	834.00	137.00
Provision of Auto Analyser for Agronomic and Soil Studies	....	10,400.00	10,149.43	250.57
Scholarship—P. H. Hodge	1,950.00	1,957.30	3,907.30	....
Seed Counter for Durum Wheat	1,100.00	700.00	1,804.00	*Dr.* 4.00
The Chemistry of Soil Nitrogen in Relation to Wheat Production	36.76	....	....	36.76
The Use of First Generation Hybrid Seed for Commercial Wheat Production	3,456.36	2,050.00	4,437.54	1,068.82
Travel Grant for Integration of Wheat Research	....	400.00	726.49	*Dr.* 326.49
Wheat Frost Injury Biochemistry of Resistance Mechanism	2,092.43	8,123.66	8,711.33	1,504.76
Yanco Agricultural Research Station—Trust Account	11,253.72	6,263.93	5,461.79	12,055.86
	$3,918,429.74	$12,596,847.58	$11,932,260.71	$4,583,016.61

COMMONWEALTH GRANT FOR STATE SECONDARY SCHOOLS—TECHNICAL TRAINING PROJECTS

These funds are made available by the Commonwealth under the States' Grants (Technical Training) legislation. Works are still in progress, financed by funds made available from 2 separate trienniums, viz., 1965–66 to 1967–68 and 1968–69 to 1970–71.

Below is a summary of receipts and expenditure in respect of this grant:

First Triennium (1965–66 to 1967–68)—

	$	$	$
Grant received from Commonwealth			800,000.00
Expenditure to 30th June, 1969		747,291.30	
Expenditure during 1969–70—			
Buildings—			
Hawkesbury Agricultural College—			
Animal Husbandry Unit	1,141.69		
Renovation of Science Block	404.25		
Steam line from Dairy to Kitchen	39,140.00		
Wagga Agricultural College—			
Engineering and Farm Demonstraion Unit	1,997.62		
Extensions to Graham Block—Biological Laboratory, Lecture Room, and Library	1,713.99		
		44,397,55	
			791,688.85
Balance of funds for completion of Works in progress at 1st July, 1970			$8,311.15

Second Triennium (1968–69 to 1970–71)—

	$	$	$
Advances received from Commonwealth—			
1968–69			102,800.00
1969–70			628,300.00
			$731,100.00
Expenditure to 30th June, 1969		79,309.74	
Expenditure during 1969–70—			
Buildings—			
Hawkesbury Agricultural College—			
Animal Husbandry Unit	47,759.00		
Agricultural Machinery Shed	13,327.39		
Beef Cattle Section	8,634.00		
Meat Production, Storage, and Demonstration Centre	6,134.06		
Omnibuses	26,539.70		
Physics Laboratory and Lecture Room	44,895.55		
Yards for Bulls	3,607.84		
Wagga Agricultural College—			
Animal and Plant Science Laboratory	196,279.38		
Livestock Demonstration Rooms and Dairy	45,606.00		
Orchard Section Renovations	14,460.65		
Yanco Agricultural College—			
Accommodation Block	261,377.78		
Equipment—			
Hawkesbury Agricultural College	21,320.85		
Wagga Agricultural College	104.36		
Yanco Agricultural College	5,261.16		
		695,307.72	
			774,617.46
Balance of advance for Second Triennium			$43,517.46

COMMONWEALTH GRANTS FOR COLLEGES OF ADVANCED EDUCATION

Commonwealth legislation provides for grants towards State expenditure on advanced education for courses of instruction which comply with conditions laid down. These grants have been made in 3 ways, viz.—

(1) For financing of major capital projects on a $1 for $1 basis by the Commonwealth and the State General Loan Account.

(2) The unmatched library grants as straight-out grants.

(3) Contribution towards recurrent expenditure on the basis of $1 by the Commonwealth for every $1.85 expenditure by the State.

Expenditure on the programme during 1969–70 is summarized below under the above headings:

	$	$
(1) Major Capital Projects—		
First Triennium (1967–69)—		
Expenditure to 30th June, 1969		215,207.15
Expenditure during 1969–70—		
Hawkesbury Agricultural College—		
Equipment for Cannery	50,094.42	
Erection of Poultry Section	30,487.40	
Equipment and Furniture	38,194.63	
Laboratory and Lecture Room for Dairy Technology Course	2,886.06	
Residential Accommodation	109,225.50	
Orange Agricultural College—		
Development Survey	1,937.35	
Wagga Agricultural College—		
Animal and Plant Science Laboratories—Stage I	21,289.94	
Augmented Water Supply	570.42	
Boiler and Hot Water Mains	5,000.00	
Development Plans	1,026.45	
Dining Room and Kitchen	89,391.08	
Equipment and Furniture	29,290.93	
Residential Accommodation	202,058.93	
Sports Facilities	4,270.00	
		585,723.11
Total Expenditure to 30th June, 1970		$800,930.26
Second Triennium (1970–72)—		
Expenditure during 1969–70—		
Hawkesbury Agricultural College—		
Equipment for Cannery	8,876.66	
Equipment and Furniture	218.70	
Erection of Poultry Section	16,919.31	
P.A.B.X. System	98.57	
Residential Accommodation	79,891.47	
School of Food Technology	30,531.20	
Wagga Agricultural College—		
Animal and Plant Science Laboratories	5,980.00	
Dining Room and Kitchen	96,759.35	
Equipment and Furniture	50.00	
Residential Accommodation	131,179.48	
Sinking of Deep Bore	8,500.00	
Total Expenditure to 30th June, 1970		$379,004.74
Total Expenditure—both Trienniums		$1,179,935.00

	$	$
(2) Unmatched Library Grant—		
Hawkesbury Agricultural College—		
Expenditure—		
1968–69	1,081.67	
1969–70	3,252.65	
		4,334.32
Wagga Agricultural College—		
Expenditure—		
1968–69	3,067.08	
1969–70	375.76	
		3,442.84
Total Expenditure to 30th June, 1970		$7,777.16

(3) Contribution to Recurrent Expenditure—

Hawkesbury Agricultural College was eligible in respect of some courses for the contribution by the Commonwealth during the 1969 calendar year and the Wagga Agricultural College Diploma Course became eligible in the 1970 calendar year. The Commonwealth contribution is paid direct to the State Treasury.

Swine Compensation Fund

A summary of the operations on the fund is set out hereunder:

	$	$
Balance as at 1st July, 1969		684,161.17
Receipts—Stamp Duty		104,175.53
		$788,336.70
Payments—		
Swine Compensation	14,834.89	
Administration Costs	5,053.73	
		19,888.62
Balance as at 30th June, 1970		$768,448.08

Cattle Compensation Fund

		$	$
Balance as at 1st July, 1969			1,841,810.96
Add Receipts—			
Levy		224,667.09	
Stamp Duty		147,949.75	
Interest		54,000.00	
			426,616.84
			$2,268,427.80
	$	$	$
Deduct Payments—			
Compensation		288,267.98	
Administrative Costs—			
Allowances to Secretaries of Pastures Protection Boards	5,412.28		
Department of Agriculture	16,942.64		
		22,354.92	
			310,622.90
Balance as at 30th June, 1970			$1,957,804.90

The following statistical information is furnished in connection with the payment of cattle compensation amounting to $288,267.98:

Disease	Claims			Animals			Payments		
	Reg 5	Reg 6	Total	Reg 5	Reg 6	Total	Reg 5	Reg 6	Total
							$	$	$
Tuberculosis	332	108	440	735	705	1,440	28,186.47	12,312.39	40,498.86
Cancer	3,526	300	3,826	4,511	797	5,308	147,608.07	22,609.14	170,217.21
Actinomycosis	1,689	15	1,704	1,946	15	1,961	57,905.29	873.14	58,778.43
Actinobacillosis	474	15	489	549	16	565	16,647.52	860.31	17,507.83
Pleuro-pneumonia contagiosa	4	..	4	4	..	4	400.00	..	400.00
Trichomoniasis	..	..	..	..	..	..	..	..	..
Tick Fever	9	..	9	9	..	9	683.25	..	683.25
Johne's Disease	2	..	2	2	..	2	92.40	..	92.40
Vibriosis	1	..	1	1	..	1	90.00	..	90.00
Totals	6,037	438	6,475	7,757	1,533	9,290	251,613.00	36,654.98	288,267.98

Commonwealth Extension Services Grant

Commonwealth grants for extension are now amalgamated under the one heading (above). When this was effected, an assurance was given that such grants would continue until 1971–72.

Expenditure during the last 3 financial years is summarized below:

Item	1967–68	1968–69	1969–70	Total
	$	$	$	$
Research Officers	37,810.06	65,074.86	109,491.84	212,376.76
Extension Officers	121,576.47	156,271.81	178,737.60	456,585.88
Field Assistants	98,682.94	109,152.82	134,733.67	342,569.43
Technical and Laboratory Assistants	37,386.09	46,742.05	70,818.71	154,946.85
Equipment for Officers	57,048.83	217,664.54	122,092.28	396,805.65
Motor Vehicles	32,334.56	69,100.00	29,485.05	130,919.61
Buildings	30,810.04	103,829.40	444,221.59	578,861.03
Agricultural Trainees	..	..	33,336.26	33,336.26
Materials for Demonstrations	12,409.34	23,850.38	..	36,259.72
Extension Aids	22,604.59	31,239.19	20,990.73	74,834.51
Library Services	41,575.18	31,503.69	15,640.85	88,719.72
Conferences and Tours (Study) Overseas	66,942.02	24,572.01	24,534.17	116,048.20
Grade Herd Recording	76,617.99	71,200.00	71,200.00	219,017.99
Conferences and Study Tours—Australia	..	61,184.81	12,925.49	74,110.30
In Service Training	..	..	2,681.26	2,681.26
Post-Graduate Training	..	..	4,394.65	4,394.65
Totals	$635,798.11	$1,011,385.56	$1,275,284.15	$2,922,467.82

In addition to the foregoing expenditure, the following amounts were financed from the "Sale of Assets" Account during 1969–70: Publications—$880.00; Furniture for the Sheep Fertility Laboratory, Trangie—$1,173.41; and an additional Overseas Visit—$485.69.

Noxious Insects Destruction Account

The Noxious Insects Act, 1934, provides for the striking and collection of a levy under certain specified conditions. Moneys received from the levy are paid into Special Deposits Account and applied by the Minister for the purposes of the Act.

Following is a Statement of Receipts and Payments during 1969–70:

RECEIPTS	$	PAYMENTS	$
Balance as at 1st July, 1969	238,330.34	Contribution to Australian Locust Patrol Service	5,950.00
Levies	134,238.31	Five (5) Radio Transceivers	1,839.00
Advanced from Consolidated Revenue Fund	250,000.00	Helicopter and Aircraft Hire	45,703.64
		Insecticide	28,974.97
		Materials and Sundry Purchases	11,001.55
		Balance as at 30th June, 1970	529,099.49
	$622,568.65		$622,568.65

Potato Growers' Licensing Act

Transactions on this account for the year 1969–70 were as follows:

RECEIPTS	$	PAYMENTS	$
Balance as at 1st July, 1969	1,221.71	Grants to Potato Growers' Association	5,340.00
Licence Fees	4,972.06	Balance as at 30th June, 1970	853.77
	$6,193.77		$6,193.77

Shannon Vale Nutrition Station–Working Account

Following is a statement of Receipts and Payments for the year ended 30th June, 1970:

RECEIPTS	$	PAYMENTS	$
Balance as at 1st July, 1969	33,995.22	Wages	7,169.16
Sale of Wool	7,475.06	Shearing	656.00
Sale of Sheep and Sheep Skins	1,370.50	Motor Fuel	232.86
Refund on Returnable Containers	64.00	Vaccines	118.59
Rental of Cottage	219.95	Fodder	958.74
		Workers' Compensation Insurance	100.56
		Payroll Tax	149.25
		Equipment	1,657.55
		Plant Repairs	530.70
		Purchase of Sheep	2,000.00
		General Supplies	870.31
		Balance as at 30th June, 1970	28,681.01
	$43,124.73		$43,124.73

STATEMENT OF RECEIPTS—CONSOLIDATED REVENUE FUND—FINANCIAL YEAR, 1969–70

Head of Receipt	Net Receipts	
	$	$
Receipts for Services Rendered—		
Agricultural Colleges and Farms—		
Rents	68,617.72	
Students' Fees	204,252.85	
		272,870.57
Fees—		
Jurors' Fees	....	
Witnesses' Expenses	21.81	
Examination Fees	51.00	
Apiary Registrations	4,701.76	
Grading—Dairy Industry Act	151.47	
Registration—Dairy Industry Act	62.00	
Dairy Science Schools	1,123.50	
Farm Produce Agents' Act	580.90	
Fertilizer Act	2,210.90	
Pest Destroyers Act	3,674.40	
Registration of Stock Brands	8,124.27	
Registration of Swine Brands	386.80	
Stock Foods and Medicines Act	8,671.90	
Veterinary Surgeons' Act	4,007.39	
		33,768.10
Contributions—		
Commonwealth Government—		
Administration of Plant Quarantine	241,936.65	
Administration of Animal Quarantine	135,955.00	
Administration of Commerce Act	85,340.20	
Maintenance of Gardens at Admiralty House	12,021.62	
Milk Board of New South Wales—		
T.B. Testing in Dairy Herds	4,262.77	
		479,516.24
Miscellaneous Services Rendered—		
Plant Diseases Act—Inspection and Fumigation Fees	945.38	
Meat Industry Act—Meat Inspection Fees	1,300,103.84	
Commonwealth Scientific and Industrial Research Organization—Subsidy of Vegetable Growing at Hawkesbury Agricultural College	500.00	
Herd Recording Fees	218,332.97	
Seed Testing and Certification Fees	35,270.99	
Administration of Cattle Compensation Fund	16,942.64	
Administration of Swine Compensation Fund	5,053.73	
Commission for Collection of Premiums	6,566.40	
Other Miscellaneous Receipts	109,983.27	
		1,693,699.22
Total—Receipts for Services Rendered		$2,479,854.13
General Miscellaneous Receipts—		
Rents exclusive of land	8,722.00	
Fines and Forfeitures	35,458.52	
Sale of Farm Produce	388,276.52	
Sale of Government Property	9,298.49	
Commonwealth Government Contribution for Cattle Tick Control	382,409.00	
Repayment to credit of Consolidated Revenue Fund—Previous Years	170,742.07	
Transfers of Part Balances not required	327.23	
Broadcasting Fees	15.00	
Gas and Electricity	10,058.94	
Postages	286.20	
Telephone Calls (Private)	5,806.02	
3 per cent contribution—Pastures Protection Boards	66,428.48	
Employer's Liability to State Superannuation Fund	5,922.18	
Commonwealth Grant towards cost of Herd Recording	71,200.00	
Commonwealth Contribution—Tuberculosis and Brucellosis Eradication	32,200.00	
Commonwealth Contribution under States' Grants (Advanced Education) Act	8,985.00	
Other Miscellaneous Receipts	270.97	
		1,196,406.62
Grand Total—All Revenue		$3,676,260.75

MISCELLANEOUS ACCOUNTS

Veterinary Surgeons' Act, 1923 (as amended)

The Act provides for the establishment of the Board of Veterinary Surgeons of New South Wales. Fees and penalties collected under the Act are paid to the credit of Consolidated Revenue Fund from which the administrative expenses of the Board are met.

As at 30th June, 1970, there were 821 registered Veterinary Surgeons.

Following is a Statement of Receipts and Payments for the year ended 30th June, 1970:

Receipts	$	Payments	$
Registration Fees	282.75	Salaries	2,023.13
Roll Fees	3,505.74	Members' Fees	630.00
Restoration Fees	18.90	Travelling Expenses	23.71
Approval to Practice under Supervision	60.00	Postal Expenses	220.00
Fines	50.00	Examination Fees	225.00
Examination Fees	90.00	Printing and Stationery	488.47
		Minor Expenses	17.40
		Excess of Receipts over Payments	379.68
	$4,007.39		$4,007.39

Meat Inspection Service

The Meat Inspection Service is administered by virtue of the Meat Industry Act, 1915, which makes provision for a scale of inspection fees.

Following is a Statement of Receipts and Payments in connection with the service for the 12 months ended 30th June, 1970.

Receipts	$	Payments	$
Inspection Fees—		Salaries and Wages	958,161.17
Regulation No. 7	136,583.09	Temporary Assistance	12,459.78
Regulation No. 8	172,741.00	Allowances	497.28
Regulation No. 9	249,385.75	Retirement Leave	4,354.53
Regulation No. 9B	657,165.70	Metropolitan Meat Industry Board Endowment Fund Contribution	6,850.00
Regulation No. 10	84,228.30	Overtime	12,407.48
		Tea Money	6.80
		Rent	1,702.40
		Travelling Expenses	76,736.21
		Motor Vehicle—Running Cost	686.92
		Freight and Cartage	134.38
		Books and Periodicals	154.38
		Postal and Telephone Expenses	1,523.44
		Fees for Services Rendered	615.90
		General Stores	5,686.67
		Gas and Electricity	72.39
		Printing	1,040.59
		Excess of Receipts over Payments as at 30th June, 1970	217,013.52
	$1,300,103.84		$1,300,103.84

The above statement does not take into account overhead expenses amounting to $194,124.19. These include Employer's Superannuation Contribution; Workers' Compensation Insurance; and Payroll Tax, calculated at 20 per cent of the cost of Salaries and Wages ($970,620.95). This reduces the excess of receipts over payments to $22,889.33.

Fund Created by the Wheat Marketing (Barring of Claims) Act, 1929 (as amended)

Revenue Account for the year ended 30th June, 1970

	$		$
To Commitments Account	5,200.00	By Interest on Investments (including Savings Bank Interest)	5,289.17
To Accumulated Funds Account	89.17		
	$5,289.17		$5,289.17

Balance Sheet as at 30th June, 1970

Liabilities	$	$	Assets	$
Accumulated Funds—			Investments in Government Securities (at face value)	103,000.00
Balance as at 1st July, 1969	103,204.67		Commonwealth Savings Bank	4,117.94
Add—			Interest accrued to 30th June, 1970	1,084.27
Over-commitments previous years	343.77			
Net Surplus for the year ended 30th June, 1970	89.17	103,637.61		
Commitments as at 30th June, 1970		4,564.60		
		$108,202.21		$108,202.21

Dairy Products Factory—Hawkesbury Agricultural College

The operations of the Dairy Products Factory for the financial year 1969–70 resulted in a net loss of $29,261.89. The loss for the previous financial year was $41,931.71. The improvement has been a result of better seasonal conditions, with an increased supply of surplus milk for manufacturing purposes. There was a further increase in consumption of Board milk. The surplus milk intake, although considerably in excess of that for 1968–69, was still well below the 1967–68 level.

Following are the abridged accounts for 1969–70:

Manufacturing and Trading Account for the Year ended 30th June, 1970

	$		$
Stock on hand at 1st July, 1969	10,828.02	Sales	341,257.56
Purchases	274,019.09	Stock on hand at 30th June, 1970	15,483.04
Repairs and Maintenance	7,307.39		
Fuel, Light, and Power	5,959.94		
Water	2,815.72		
Salaries and Wages	23,765.86		
Workers' Compensation Insurance	454.63		
Payroll Tax	594.16		
Superannuation—Employer's Liability	1,990.26		
Depreciation	22,120.82		
Sundry Expenditure	417.93		
Gross Profit	6,466.78		
	$356,740.60		$356,740.60

Profit and Loss Account for the Year ended 30th June, 1970

	$		$
Salaries and Wages	13,269.43	Gross Profit from Trading Account	6,466.78
Payroll Tax	331.50	Sundry Income	43.32
Workers' Compensation Insurance	253.83		
Superannuation—Employer's Liability	449.58		
Levies—Butter and Cheese	690.84		
Freight and Cartage	328.48		
Laboratory Expense	682.18		
Repairs and Maintenance	31.46		
Telephone	450.95		
Depreciation	1,093.04		
General Expenses	279.12		
Printing and Stationery	115.25		
Interest on Capital	17,796.33	Net Loss for 1969–70	29,261.89
	$35,771.99		$35,771.99

Appropriation Account for the Year ended 30th June, 1970

	$		$
Net Loss—1969–70	29,261.89	Balance at 1st July, 1969	2,979.51
Balance as at 30th June, 1970	5,255.54	Expenditure not met from Working Account	21,537.92
		Adjustment—Step-up 1968–69	10,000.00
	$34,517.43		$34,517.43

APPENDIX II

PUBLISHED MATTER,* 1969-70

*Viz: Matter printed as Department of Agriculture (D. of A.) booklets, or contributed to or printed as articles either in Department of Agriculture journals (the monthly *Agricultural Gazette of N.S.W.*, the quarterly *Review of Marketing and Agricultural Economics*, bi-monthly *Dairy Topics*, quarterly *Poultry Notes*, quarterly *Veterinary Notes*) or the journals of other institutions/organizations; papers presented at technical conferences for which there are published records; and theses presented for higher degrees.

The Appendix does not list the many times greater volume of items contributed in the course of extension work through such channels as the Department's *Press Releases*, and the Regional/District publicity releases for newspapers, radio stations, and primary producers. Indications of the volume of this published matter are included in this Report under "Division of Information Services" and "Division of Extension Services".

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DECENTRALIZED AGRICULTURAL RESEARCH DIRECTORATES

(i) AGRICULTURAL RESEARCH INSTITUTE, WAGGA WAGGA

Contributions to Journals

Cuthbertson, E. G. (1970). *Chondrilla juncea* in Australia. 3. Seed maturity and other factors affecting germination and establishment. Aust. J. Exp. Agric. Anim. Husb. 10 (42): 62.

Pugsley, A. T. (1970). From one bushel to 215 million of wheat in New South Wales. Agric. Gaz. N.S.W. 81 (4): 196. (A treatment associated with the Cook Bi-Centenary Year Celebrations.)

Smith, A. N. (1969). Phosphataufnahme durch Weizen und Klee aus vier anorganischen Badenphosphaten nach Zugabe verschiedener phosphathaltiger Düngemittel. Die Phosphorsäure 28: 89.

Smith, A. N. (1969). Fractionation of inorganic phosphorus in soils. The Chang and Jackson fractionation procedure: its limitations and uses. Agric. Digest No. 17: 10.

Storrier, R. R., Hanly, A. T., and Nicol, Helen I. (1970). An evaluation of indices of available soil nitrogen. Aust. J. Exp. Agric. Anim. Husb. 10 (42): 89.

Syme, J. R. (1969). A comparison of semi-dwarf and standard height wheat varieties at two levels of water supply. J. Exp. Agric. Anim. Husb. 9 (40): 528.

Syme, J. R. (1970). A high-yielding Mexican semi-dwarf wheat and the relationship of yield to harvest index and other varietal characteristics. Aust. J. Exp. Agric. Anim. Husb. 10 (44): 350.

Warren, J. F. (1969). Australian wheat yield trends. J. Aust. Inst. Agric. Sci. 35 (4): 240.

(ii) AGRICULTURAL RESEARCH DIRECTORATE, TAMWORTH

Contributions to Journals

Banath, C. L. (1969). Iron pyrites as a sulphur fertilizer. Aust. J. Agric. Res. 20: 697.

Kochman, J. K. (Uni. of N.E.) and Evans, G. (1969). Fungi associated with root rot of irrigated safflower in the Namoi Valley, New South Wales. Aust. J. Exp. Agric. Anim. Husb. 9 (41): 644.

Symes, K. J. (1969). Influence of a gene causing hardness on the milling and baking quality of two wheats. Aust. J. Agric. Res. 20: 971.

Contributions to Technical Conferences

Evans, G. (1969). Influence of weed hosts in the ecology of *Verticillium dahliae* in newly cultivated areas of the Namoi Valley. To the ANZAAS Congress, Adelaide, Aust.

(iii) AGRICULTURAL RESEARCH DIRECTORATE, WOLLONGBAR

Staff under the Director of Research, Agricultural Research Station, Wollongbar are positioned at the Station by various Divisions of the Department. Therefore their publications are listed elsewhere in this *Appendix*, under the appropriate Divisional heading (Division of Plant Industry, Division of Animal Industry, Division of Marketing and Agricultural Economics, or the Biological and Chemical Research Institute, as the case may be).

DIVISION OF MARKETING AND AGRICULTURAL ECONOMICS

D. of A. Bulletins, Booklets, Leaflets

Standen, B. J. (1969). Changes in land use in the Richmond-Tweed Region of New South Wales 1958 to 1967. D.M.A.E. Misc. Bull. No. 7.

Rowe, Carolyn (1969). Financial results of a survey of the broiler growing industry in New South Wales. D.M.A.E. Misc. Bull. No. 8.

Ryan, J. G. (1969). Input-output data, resource restrictions and a programming matrix for rice farms in the Murrumbidgee Irrigation Areas. D.M.A.E. Misc. Bull. No. 9.

Standen, B. J. (1970). Direct costs and returns from the installation and operation of refrigerated milk vats—the farmer's viewpoint. D.M.A.E. Misc. Bull. No. 10.

Swain, F. G., Bird, J. G., and Drane, F. H. (1970). Case studies of feed year development in the red soils area—far north coast, New South Wales. D.M.A.E. Misc. Bull. No. 11.

Contributions to Journals

Buffier, B. D. (1970). Sell out, get out, battle on or adjust and change. Power Farming and Better Farming Digest 79 (5): 37.

Duncan, R. C. (1969). An investigation of the trial stage in the adoption process: aerial topdressing in the Clarence Valley. Rev. Marktg. Agric. Econ. 37 (4): 207.

Duncan, R. C. (1970). Production economics, farm management, and extension, a comment. Amer. J. Agric. Econ. 52 (1): 164.

Elston, J. W. (1970). Sheep or cattle? Agric. Gaz. N.S.W. 81 (2): 70.

Elston, J. W. (1970). Managing borrowed finance. Agric. Gaz. N.S.W. 81 (6): 338.

Elston, J. W. (1970). How to make a profit from grain drying on the farm. Power Farming & Better Farming Digest 79 (6).

Holmes, W. E. (1970). Taxation and the primary producer. Agric. Gaz. N.S.W. 81 (3): 135.

Ryan, J. G. (1969). Optimum programmes for irrigated farms. Rev. Marktg. Agric. Econ. 37 (3): 153.

Contributions to Technical Conferences

Swain, F. G., Mears, P. T., Drane, F. H., Murtagh, G. J., Bird, J. G., Colman, R. L., and Yabsley, G. M. (1970). Commercial evaluation of a new farming system. Proc. XI Int. Grasslands Cong.: 925.

Kennedy, J. R. (1970). Lamb marketing in N.S.W. Commercial aspects of prime lamb production. Proc. Sheep & Wool Seminar, 1970.

Standen, B. J. (1970). What is a low income farm problem. Ann. Conf. Aust. Agric. Econ. Soc.

HAWKESBURY AGRICULTURAL COLLEGE

Contributions to Journals

Baumgartner, P. A. (1969). Smallgoods curing techniques. Meat Ind. Bull. 12 (7).

Baumgartner, P. A. (1969). Meat and its function as a raw material for smallgoods. Meat. Ind. Bull. 12 (10).

Maxwell, M. K. (1967; not previously reported). A cytological study of some orchid genera. The *Dendrobium kingianum* Bidw. ex Lindl. complex, parts I, II, and III. Aust. Orchid Rev. 25–30, 81–8, 139–41.

Mullin, M. (1970). Tissue culture of some monocotyledenous plants. Aust. J. Biol. Sci. 23: 473.

Sumeghy, J. B. (1969). Vegetable mechanization. Agric. Gaz. N.S.W. 81 (6): (in press).

Contributions to Technical Conferences

Baumgartner, P. A. (1969). Principles of preservation. 10th winter school ("The Foreman in the Food Plant"). Publd. by Food Technol. Assoc. N.S.W.

Baumgartner, P. A. (1970). Food technology training at H.A.C. 4th Annual Conv. Aust. Inst. Food Sci. & Technol., Melbourne.

Fowler, D. G. and Jenkins, L. D. (1970). The effect of fertility of the ram group on the reproductive performance of the flock. Proc. Aust. Soc. Anim. Prod.

Sumeghy, J. B. (1969). Effect of plastic on the yield of trellised tomatoes. To 3rd Aust. Veg. Conf., Terrigal, N.S.W.

Sumeghy, J. B. (1969). Mechanization—seeding, thinning and harvesting. Review paper, to 3rd Aust. Veg. Conf., Terrigal, N.S.W.

APPENDIX III

Notes from:

A. The Chief Biometrician

B. The Senior Clerk (Central Administration)

APPENDIX IIIA

NOTES FROM THE BIOMETRICAL BRANCH

NEW LOCATION

The Biometrical Branch has been re-located at Mark Foy Building since 29th May, 1970.

STAFF

Two trainees in agricultural science and a trainee in mathematics completed their studies and took up duty as Biometricians in January, 1970. One officer commenced National Service in January, 1970. Another was appointed in a supernumerary Biometrician position in December, 1969.

All professional staff of this Branch are graduates who have specialized in mathematics and statistics. All have had training in programming computers for analysis of experimental data.

GENERAL

Main function of the Branch is advice to research workers on the design of experiments and on the analysis and interpretation of data from designed experiments and the survey types of investigation. At the start of an investigation the Biometrician is called upon to clarify and define objectives, select the most appropriate type of experiment to answer the questions posed, and decide the plans and procedures. On completion of the experimental work he does the statistical analysis, advises on the interpretation of results and may assist the preparation of material for publication.

The volume of consulting work continued to increase in line with the increase in the level of training of research staff in the Department.

Two major computer programmes were completed. These will permit more thorough examination of data, and the analysis of some types of experiments that could not until now be handled by computer.

Regular visits to Research Stations provided on-the-spot consultations but, also, arrangements have been made for 2 Biometricians to be located on Research Stations in the ensuing year.

PUNCH CARD SECTION

This section is concerned with punching data into cards for input to computers. Since the move to the Mark Foy building the Biometrical Branch has been responsible only for the punching of biometrical programmes and research data for statistical analysis. Punching of Dairy Herd Recording records and of economic and data processing programmes has become the responsibility of the Automatic Data Processing Section of the Department.

APPENDIX IIIB

STAFF AND PERSONNEL BRANCH NOTES, FROM THE SENIOR CLERK (CENTRAL ADMINISTRATION)

STAFF SECTION

Salary Agreements, Determinations, Awards Processed

Ten new salary Agreements and 2 new Awards were processed.

Staff Numbers

The Departmental establishment for officers, employees and trainees at 30th June, 1970, may be summarized thus:

Professional Officers	878	
Administrative and Clerical Officers	553	
General Division and Ministerial Staffs	2,384	
Sub-total		3,815
University and College trainees, including intake for 1971	252	
Grand total		4,067

This year, 172 new positions were created. Of these, 68 were within the Professional, 11 in the Administrative and Clerical, and 93 in the General Division. The net overall increase for the year was 149; since 10 positions were deleted from the Professional, 1 from the Administrative and Clerical, and 12 from the General Division.

Also, 23 Ministerial employees were brought under Section 44 of the Public Service Act.

An interesting observation is that in 7 years, from 30th June, 1963 to 30th June, 1970 the total complement of this Department has increased from 3,054 to 4,067; an increase by more than one third of the earlier total.

New Senior Positions

Principal, Agricultural College, Orange; Principal, C. B. Alexander Agricultural College, Tocal; Deputy Principal, C. B. Alexander Agricultural College, Tocal; Executive Officer (Agricultural Education); Senior Clerk (Agricultural Education), Deputy Director, Agricultural Research Institute, Wagga; and Principal Officer (Pest Destroyers).

In the Division of Animal Industry, the new senior positions are: Assistant Principal Veterinary Officer (T.B. and Brucellosis); Assistant Principal Livestock Officer (Beef Cattle, Horses, and Goats); Assistant Principal Livestock Officer (Poultry); and Assistant Principal Livestock Officer (Sheep and Wool). The latter 3 were by re-classification.

In the Division of Horticulture the new senior position is that of Assistant Principal Fruit Officer (Regulatory).

In the Division of Extension Services the 2 new senior positions are Assistant Principal Extension Officer (Lismore) and Assistant Principal Extension Officer (Goulburn).

In the Division of Research Stations the 2 new positions are Deputy Chief, Division of Research Stations; and Assistant Manager, Agricultural Research Station, Trangie.

In the Division of Plant Industry the new position is that of Special Agronomist (Irrigation).

At Hawkesbury Agricultural College the new senior positions are: Senior Lecturer (Poultry Technology); Senior Lecturer (Agricultural Economics/Farm Management); and Senior Lecturer (Rural Extension); the latter 2 by re-classification.

Appointments/Promotions of Senior Officers

Appointments/promotions comprised the following tabulated alphabetically: N. Baker as Special Economist (Commodities); D. K. Bartels as Executive Officer, Hawkesbury Agricultural College; L. H. Bird from Senior Research Officer to Deputy Director, Agricultural Research Institute, Wagga; E. W. Bowmaker from Principal Agronomist (Extension) to Deputy Chief, Division of Plant Industry; E. A. L. Bragg from Assistant Accountant to Accountant; G. A. Crawford from Principal Agronomist, Division of Plant Industry, to Deputy Chief, Division of Research Stations; J. H. Duncan to Assistant Principal Fruit Officer, Division of Horticulture; G. R. Gregory from Deputy Chief to Chief, Division of Horticulture; L. R. Kavanagh from Deputy Chief to Chief, Division of Plant Industry; J. K. Long from Principal Fruit Officer (Research) to Deputy Chief, Division of Horticulture; G. C. McFarlane as Principal, C. B. Alexander Agricultural College, Tocal; J. J. Simes from Senior Clerk, Division of Animal Industry, to Assistant Accountant; B. W. Urquhart as Deputy Principal, C. B. Alexander Agricultural College, Tocal; and D. E. Weedman to Principal Officer (Pest Destroyers).

Promotion Statistics

Officers promoted during the year totalled 252. Seventy-three were promoted out of seniority order.

Some Special Reclassifications

Four Technical Officers (Scientific) of the Veterinary Research Station, Glenfield, were reclassified as Senior Medical Technologists (G. A. Hendy, D. W. Dredge, W. S. Turvey, and E. M. Batty).

Retirements

Tabulated alphabetically: A. A. Ashton, Garden Labourer; J. D. Barratt, Assistant (Livestock); F. E. D. Brice, Cattle Inspector; L. R. Chessor, Field Assistant; H. W. Crane, Clerk; J. T. Crotty, Assistant Inspector of Stock; A. T. Gardener, Gatekeeper; Miss H. Gordon, Stenographer; J. A. Hobbins, Inspector-in-Charge; R. G. Irvine, Dairy Officer; Miss M. I. Justelius, Senior Machine Operator; A. W. Kilmurray, Assistant Inspector of Stock; R. N. McCullock, Director, Cattle Tick Research Station, Wollongbar; W. Mutch, Patrolman; A. C. Orman, Chief, Division of Plant Industry; R. C. Roberts, Herd Recorder; A. R. Roy, Cattle Inspector; K. A. Russell, Accountant; Miss H. A. Smellie, Clerk; and J. S. Wilson, Dairy Officer.

Deaths

Mr P. J. Bramley, Herd Recorder; Mr N. A. Christie, Meat Inspector; Mr T. C. H. Dixon, Garden Labourer; Mr J. Grant, Meat Inspector; Miss L. N. Grimsley, Stenographer; Mrs J. A. Hackett, Matron, Wagga Agricultural College; Mr J. M. Hodges, Lecturer, Hawkesbury Agricultural College; Mr F. J. Nicholson, Regional Supervisor; Mr F. T. Rundle, Senior Assistant Inspector of Stock; Mr R. G. Spencer, Patrol Officer; and Mr M. H. Waters, Herd Recorder.

Officers Undertaking or About to Undertake Post-Graduate Study Within Australia

The following professional officers were, and in the majority of cases are still, at Universities within Australia—working towards higher degrees in subject-matter areas appropriate to the Department's responsibilities: T. S. Abbott, Chemist, 3 years from 13th March, 1967 to 22nd July, 1970, on a Commonwealth Research Studentship at the University of Sydney; K. G. Beirne, Lecturer, for 1970 academic year to undertake post-graduate studies at the Waite Agricultural Research Institute, South Australia; M. H. Campbell, Agronomist, 3 years from January, 1968, on Wool Board Scholarship, for studies towards Ph.D. at the University of New England; A. D. Clift, Entomologist, 3 years from 10th March, 1969, on a Commonwealth Research Studentship towards Ph.D. at University of Sydney; R. L. Colman, Research Agronomist, 3 years from March, 1967 to February, 1970, on Post-Graduate Scholarship towards Ph.D. at University of New England; E. J. Cother, from February, 1970 to December, 1970 (in first instance) to study for Ph.D. at University of Sydney; F. R. Doughty, Veterinary Research Officer, for 3 years from January, 1970, to undertake post-graduate training at University of Sydney; G. P. Gard, Veterinary Officer, for 3 years from June, 1967 to May, 1970, to undertake studies for Ph.D. at Australian National University; B. A. Hamilton, Livestock Research Officer, for 3 years from September, 1967 to August, 1970, to study towards Ph.D., on Wool Board Scholarship at University of New England; H. Hearnshaw, Livestock Research Officer, 3 years from 1970 for post-graduate studies for Ph.D. at University of Melbourne; L. A. Hilton, Soil Chemist, for 2 years from March, 1968 to March, 1970, to study for Master of Science Degree at University of Sydney; P. J. Holst, Livestock Research Officer, up to 3 years from 1st February, 1969 for post-graduate training at the School of Biological Science, Macquarie University; E. M. Matheson, Senior Research Officer, 3 years from June, 1967 to June, 1970 for temporary lectureship at the University of New England; P. A. McInnes, Livestock Research Officer, 3 years from March, 1967 to March, 1970, to study for Ph.D. at University of Western Australia; P. T. Mears, Agronomy (Research Officer), for 2 years from June, 1969, to study for Ph.D. at University of Queensland; P. J. Milham, Chemist, from June, 1969 (up to 5 years), to undertake Ph.D. studies at Macquarie University; J. M. Morgan, Research Agronomist, 3 years from 1970, to undertake Ph.D. at Macquarie University; M. V. Petruchenia, Extension Officer (Group Extension), from 2nd March, 1970 to 31st December, 1971, for study towards M.Sc. at University of New South Wales; L. C. Pryde, Livestock Officer (Sheep and Wool), from March, 1969, awarded Traineeship in Veterinary Science at University of Sydney; G. E. Robards, Livestock Officer (Research), for 3 years from January, 1968 to January, 1971, for post-graduate studies towards Ph.D. at University of Melbourne; W. Rohan-Jones, Livestock Research Officer, from 9th February, 1969 for 3 years, for a Biological Study at University of New England; E. Seif, Research Officer, for the 1970 academic year, for post-graduate study at University of Sydney; N. L. Wade, Fruit Officer, 3 years from January, 1967 to December, 1969, for Commonwealth Post-Graduate Scholarship at University of Sydney; D. L. Watson, Trainee (Livestock Officer), from February, 1970 for 3 years (12 months in first instance) to study for Ph.D. at University of Sydney.

Officers Officially Overseas for Post-Graduate Studies

The following professional officers were, and in the majority of cases are still overseas: R. B. Bonner, Veterinary Officer, from 15th September, 1969 to 28th January, 1971, to visit centres in Europe and U.K. and study at the University of London; J. W. Freebairn, Economics Research Officer, 3 years from September, 1968 to September, 1971, studying for Ph.D. at the University of California, U.S.A.; I. K. Hotson, Special Veterinary Officer, 1 year from September, 1968 to September, 1969, for Post-Graduate Studentship at Moredun Institute, Edinburgh, Scotland; C. A. W. Jackson, Veterinary Research Officer, from 26th September, 1969 to 10th February, 1971, to undertake Post-Graduate training at Houghton Poultry Research Station; D. R. Leece, Chemist, for 3 years from September, 1967 to August, 1970, on a Research Assistantship at the Michigan State University, U.S.A.; H. Marcellos, Research Officer, from September, 1967 to February, 1971, to study for Ph.D. at Illinois State University, U.S.A.; D. J. McDonald, Research Officer, for 3 years from September, 1967 to August, 1970, to visit the Philippines, Japan, Thailand, and Mexico and study at Texas A. & M. University; B. J. McGuirk, Livestock Research Officer, for 3 years from September, 1969 for Post-Graduate studies towards Ph.D. at University of Edinburgh, Scotland; R. E. Paull, Research Agronomist, for 3 years from 12th March, 1970 to January, 1973, to study for Ph.D. at University of California, U.S.A.; J. G. Ryan, Economics Research Officer, from 3rd September, 1968 to 9th September, 1971, for study towards Ph.D. at North Carolina State University, U.S.A.; R. E. Smart, Fruit Officer (Research) from 14th March, 1970 to 17th September, 1970, to participate in the XVIIIth International Horticultural Congress at Tel Aviv and undertake research on irrigation techniques at Volcanic Institute, Israel; B. R. Wilson, Livestock Research Officer, for 3 years from December, 1968, for studies for Ph.D. at University of Alberta, Canada.

Officers Officially Overseas for Special Purposes

The following professional officers were, and in the majority of cases are still overseas: B. D. Ament, Chief, Division of Extension Services, from 1st May, 1970 to 2nd July, 1970, to observe trends in Agricultural Extension in South Africa, The Netherlands, U.K., Canada, U.S.A., and New Zealand; J. H. Ballard, Special Agronomist (Seed Production), from 21st February, 1970, for 2 weeks, on Colombo Plan assignment in India; J. W. Boyle, Principal Agronomist, from 27th July, 1969 to 28th October, 1969, to investigate agronomy matters in U.S.A., U.K., Italy; Miss P. Broadbent, Plant Pathologist, from 27th October to 1st December, 1969, to attend in Japan the 5th Conference of the International Organization of Virologists; N. J. Campbell, Veterinary Research Officer, from 3rd May, 1970 to 16th May, 1970, to study research projects on liver fluke, New Zealand; P. A. Delaney, Dairy Officer, from 11th January, to 15th February, 1970, to visit South East Asian recombining plants; R. D. Eastoe, Principal Livestock Officer (Sheep and Wool), from 21st February, 1970, for 4 weeks, to undertake Colombo Plan assignments in India; I. K. Hotson, Special Veterinary Research Officer, from April, 1969 to 4th October, 1969, to undertake parasitology investigations in U.K., Europe, U.S.A.; L. A. S. Johnson, Deputy Chief Botanist, from 3rd August, 1969 to 1st November, 1969, to attend the XIth International Botanical Conference, Seattle, U.S.A.; D. J. McGillivray, Botanist, from 15th December, 1968 to 31st March, 1970, as Botanical Liaison Officer, Kew Gardens, U.K.; G. Pasfield, Chief Entomologist, from 10th May, 1970 to 10th September, 1970, *inter alia* to attend 9th Commonwealth Entomological Conference, the Commonwealth Agricultural Bureau Review Conference, and the Anti-Locust Research Centre Silver Jubilee Conference, London; J. J. Slater, Principal Extension Officer, from 4th August, 1969 to 10th November, 1969, to study extension services/methods in U.K., Europe, U.S.A., Fiji; J. W. Turpin, Principal Fruit Officer (Citrus), from 26th February to 21st May, 1970, to attend XVIIIth International Horticultural Congress, Israel; R. M. Watts, Director-General, from 3rd to 14th October, 1969, to attend Codex Committee on Pesticide Residues, Arnhem, Holland.

PERSONNEL SECTION

Employment, Induction, and Counselling Activities

Interviews and Enquiries.—Some 527 employment interviews and enquiries, 415 induction interviews, and 370 counselling interviews were handled by Personnel Section. Some 272 of the employment items comprised telephoned enquiries. Further to the employment interviews and enquiries some 397 letters were needed.

Induction Courses for Trainees.—There are now 180 Departmental trainees at the various Universities and Agricultural Colleges; involving 16 Degree or Diploma Courses. Eight of the 180 are repeating an academic year at their own expense. Fifty-nine trainees were recruited in 1970.

The 48 newly-appointed University trainees took part in a 1-day Induction Course and the 10 new trainees at Agricultural Colleges attended a similar but half-day Induction Course. The courses were in Sydney, early in 1970.

Careers Exhibition and Careers Nights

Personnel Section collaborated with other Departments to provide a Public Service Section in the Careers Exhibition at Sydney Town Hall in September, 1969. The Section also provided talks at Careers Nights at various metropolitan High Schools.

Staff Assessment, Reporting, and Guidance Scheme

This Scheme now embraces about 450 officers and employees. Since inception of the Scheme in 1967, more than 900 reports have been received and processed by Personnel Section; 322 of them in 1969–70.

Public Servants' Accommodation Scheme

A number of officers have been provided with accommodation under the scheme, but the Department has 57 applications outstanding, from officers who need such housing assistance.

Safety Matters

Personnel Section examined 445 injury reports. The Department's Safety Committee met at quarterly intervals, and enquired into and made decisions on a number of matters relative to the Safety Programme.